DISTRIBUTION, ABUNDANCE, AND DIVERSITY OF EPIFAUNAL BENTHIC ORGANISMS IN ALITAK AND UGAK BAYS, KODIAK ISLAND, ALASKA

by

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SUMMARY OF OBJECTIVES, CONCLUSIONS, AND IMPLICATIONS WITH RESPECT TO OCS OIL AND GAS DEVELOPMENT

Little is known about the biology of the invertebrate components of the shallow, nearshore benthos of the bays of Kodiak Island, and yet these components may be the ones most significantly affected by the impact of oil derived from offshore petroleum operations. Baseline information on species composition is essential before industrial activities take place in waters adjacent to Kodiak Island. It was the intent of this investigation to collect information on the composition, distribution, and biology of the epifaunal invertebrate components of two bays of Kodiak Island.

The specific objectives of this study were:

1) A qualitative inventory of dominant benthic invertebrate epifaunal species within two study sites (Alitak and Ugak bays).
2) A description of spatial distribution patterns of selected benthic invertebrate epifaunal species in the designated study sites.
3) Observations of biological relationships between segments of the benthic biota in the designated study area.

Permanent stations were established in the two bays—28 stations in Alitak Bay and 25 stations in Ugak Bay. These 53 stations were occupied with a 400-mesh Eastern otter trawl on four separate cruises in June, July, and August of 1976 and March 1977. Taxonomic analysis of the epifauna collected delineated 12 phyla, 23 classes, 66 families, 79 genera, and 106 species. Arthropoda (Crustacea) dominated in species composition and biomass. Porifera, Cnidaria, Annel.ids, Mollusca, and Echinodermata accounted for only 2. O% of the biomass collected.

Differences in sex composition and stage of maturity of king and snow crabs between and within the two bays were noted. King crabs, *Paralithodes camtschatica*, occurred mainly at the outer stations of Alitak Bay and consisted mostly of egg-bearing females and juveniles. King crabs were well dispersed throughout Ugak Bay, and mainly consisted of juveniles. Snow crabs, *Chionoecetes bairdi*, in Alitak Bay were primarily juveniles; snow crabs in Ugak Bay were primarily adult males. Preliminary life history data for these crabs for the two bays are now available.

Food data for king and snow crabs from the two bays are also available; in conjunction with similar data from Cook Inlet and the Bering Sea, these data enhance our understanding of the trophic role of these crustaceans in their ecosystems. Additional food data for three species of flatfishes, as well as an assessment of the literature, have made it possible to develop a preliminary food web for benthic and nektobenthic species of Alitak and Ugak bays and the inshore waters around Kodiak Island. Comprehension of basic food interrelationships is essential for assessing the potential impact of oil on the crab-dominated benthic systems of the nearshore waters of Kodiak.

The importance of deposit-feeding clams in the diet of king and snow crabs in the two Kodiak bays has been demonstrated by preliminary feeding data collected there. An understanding of the relationship between oil, sediment, deposit-feeding clams, and crabs should be developed in a further attempt to understand the possible impact of oil on these two commercially important species of crabs in the Kodiak area.

Initial assessment of data suggests that a few unique, abundant, and/or large invertebrate species (king crab, snow crab, several species of clams) are characteristic of the bays investigated and that these species may be useful for monitoring purposes.

A complete understanding of the benthic systems in each bay can only be obtained when the inf auna is also assessed in conjunction with the epifauna. Stomach analyses indicate that infaunal species are important food items for king and snow crabs. However, the inf aunal components of the Kodiak shelf have not yet been investigated. A program designed to examine the inf auna should be initiated.

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INTRODUCTION

General Nature and Scope of Study

The operations connected with oil exploration, production, and transportation in the Gulf of Alaska present a wide spectrum of potential dangers to the marine environment (see Olson and Burgess [1967] for general discussion of marine pollution problems). Adverse effects on a marine environment cannot be predicted or assessed unless background data pertaining to the area are recorded prior to industrial development.

Insufficient long-term information about an environment and the basic biology of species present can lead to erroneous interpretations of changes that might occur if the area becomes altered (see Pearson [19'71, 1972], Nelson-Smith [1973], and Rosenberg [1973] for general discussions on benthic biological investigations in industrialized marine areas). Populations of marine species fluctuate over a time span of a few to 30 or more years (Lewis 1970).

Benthic organisms (primarily the infauna and sessile and slow-moving epifauna) are useful as indicator species for a disturbed area because they tend to remain in place, typically react to long-range environmental changes, and, by their presence, generally reflect the nature of the substratum. Consequently, the organisms of the infaunal benthos have frequently been chosen to monitor long-term pollution effects, and are believed to reflect the biological health of a marine area (see Pearson [1971, 19'72, 1975] and Rosenberg [1973] for discussions on use of benthic organisms for monitoring pollution). The presence of large numbers of benthic epifaunal species of actual or potential commercial importance (crabs, shrimps, scallops, snails, finfishes) in the shelf ecosystem of Kodiak Island further dictates the necessity of understanding benthic communities since many commercial species feed on infaunal and small epifaunal residents of the benthos (see Zenkevitch [1963], Feder et al. [1977], and this report for a discussion of the interaction of commercial species and the benthos). Thus, drastic changes in density of the food benthos would affect the health and numbers of these fisheries organisms.

Experience in pollution-prone areas of England (Smith 1968), Scotland (Pearson 1972), and California (Straughan 1971) suggests that at the completion of an initial exploratory study, selected stations should be examined regularly on a long-term basis to determine any changes in species composition, diversity, abundance, and biomass. Long-term data should make it possible to differentiate between normal ecosystem variation and pollutant-induced biological alteration. An intensive investigation of the benthos of the Kodiak shelf, as well as its bays, is essential to an understanding of the trophic interactions there and the potential changes that could take place once oil-related activities are initiated. An intensive benthic biological program in the northeast Gulf of Alaska has emphasized the development of a qualitative and quantitative inventory of prominent species of the benthic infauna and epifauna there (Feder et al. 1976). In addition, a developing investigation concerned with the biology of selected benthic species from the northeast Gulf of Alaska and lower Cook Inlet will further our understanding of the overall Gulf of Alaska benthic system (Feder et al. 1977). A program designed to examine the subtidal benthos of the Kodiak shelf will expand the coverage of the Gulf of Alaska benthic system, and an assessment of the fauna of two Kodiak bays will extend investigations into little-known shallow-river benthic systems. The study reported here is a preliminary assessment of two shallow Kodiak Island bays, and is intended to precede a greater overall investigation of the Kodiak Island shelf.

Relevance to Problems of Petroleum Development

The effects of oil pollution on subtidal benthic organisms have generally been neglected; only the results of a few studies conducted after major oil spills have been published (see Boesch et al. [1974] for review of these papers). Thus, lack of a broad data base elsewhere makes it difficult to predict the effects of oil-related activity on the subtidal benthos of the Kodiak shelf and the two Kodiak bays investigated. However, the expansion of research activities into Kodiak waters should ultimately enable us to identify certain species or areas that might bear closer scrutiny once industrial activity is initiated. It must be emphasized that a considerable time span is needed to understand fluctuations in density of marine benthic species, and it cannot be expected that a short-term research program will result in predictive capabilities. Assessment of the environment must be conducted on a continuing basis.

Data indicating the effects of oil on most subtidal benthic invertebrates are fragmentary (Nelson-Smith 1973). The snow crab *Chionoecetes bairdi* is a conspicuous member of the shallow shelf of Kodiak Island and its bays, and supports an important commercial fishery. Laboratory experiments with snow crabs have shown that postmolt individuals lose most of their legs after exposure to Prudhoe Bay crude oil (Karinen and Rice 1974). Few other direct data based on laboratory experiments are available for subtidal benthic species (see Nelson-Smith [1973] for review). Experimentation on toxic effects of oil on other common members of the subtidal benthos should be strongly encouraged for the near future in Kodiak waters as well as for all Outer Continental Shelf (OCS) areas of investigation. In addition, potential effects of the loss of sensitive species to the trophic structure of the shelf must be examined. These problems can best be addressed once benthic food studies are made available as a result of OCSEAP research; e.g., see Feder et al. (1977) and Smith et al. (1977).

A direct relationship between trophic structure (feeding type) and bottom stability has been demonstrated by Rhoads (1974), who described a diesel-fuel oil spill that resulted in oil becoming adsorbed on sediment particles which in turn caused death of deposit feeders living on sublittoral muds. Bottom stability was altered with the death of these organisms, and a new complex of species became established in the altered substratum. Many common members of the infauna of the Gulf of Alaska are deposit feeders; thus, oil-related mortality of these species could result in a changed near-bottom sedimentary regime and alteration of species composition. In addition, the commercially important king and snow crabs, and some bottom fishes, use deposit feeders as food (Feder et al. 1977 and present report); thus, contamination of the bottom by oil might indirectly affect the commercial species around Kodiak Island.

CURRENT STATE 03? KNOWLEDGE

Little is known about the biology of the invertebrate benthos of the Gulf of Alaska; the relevant data have been compiled by Rosenberg (197’2) and AEIDC (1975). The exploratory trawl surveys conducted by the Kodiak Laboratory of the National Marine Fisheries Service (unpubl. data, no date) are the most extensive investigations of the benthic epifauna of the Kodiak shelf. However, caution must be exercised in interpreting data from these surveys because each survey was directed toward different groups or species and used different gear and sampling efforts. Some information on the epifauna in the vicinity of Kodiak Island is available from Alaska Department of Fish and Game king crab indexing surveys (unpubl. data, ADF&G, Box 686, Kodiak, AK 99615). The International Pacific Halibut Commission (1964) surveys parts of the Kodiak shelf annually, but the only invertebrates they record are the commercially important crabs.

Alitak Bay has a history as a king crab mating ground (Kingsbury and James 19’71), and has been a major producer of commercial-sized crab in the Kodiak Island area since 1953 (Gray and Powell 1966). Outer Alitak Bay was also the site of king crab distribution, abundance, and composition studies (Gray and Powell 1966; Kingsbury et al. 1974) conducted by the Alaska Department of Fish and Game during the summers of 1962 and 1970.

STUDY AREA

Alitak Bay and Ugak Bay, located on the south and east sides of Kodiak Island, respectively, were the sites of benthic trawling activities during the summer of 1976 and March 19'7'7 (Figs. 1 and 2).

SOURCES, METHODS, AND RATIONALE OF DATA COLLECTION

The epibenthos was sampled from the MV *Big Valley* during four cruises: 17–22 June, 18–28 July, and 19–29 August 1976; and 3–18 March 1977. Fifty-three permanent stations were established in conjunction with Alaska Department of Fish and Game surveys: 28 stations in Alitak Bay (Fig. 1) and 25 stations in Ugak Bay (Fig. 2). Thirty-minute tows were made at these stations using a commercial sized, 400-mesh Eastern otter trawl with a 12.2-m horizontal opening.

The numbers of stations occupied in each bay by cruise are as follows:

Cruise *date*	*Alitak Bay*	*Ugak Bay*	Total *stations*
17-12 Jun 1976	28	25	53
18–28 Jul 1976	28	25	53
19–29 Aug 1976	22	25	47
3–18 Mar 1977	21	23	44
Total	99	98	197

Bay stations were arbitrarily divided into three sections: inner stations, mid-bay stations, and outer stations (Figs. 1 and 2).

Invertebrates were sorted on board, given tentative identifications, counted, and weighed. Aliquot samples of individual species were preserved and labeled for final identification at the Institute of Marine Science, University of Alaska. Laboratory examination occasionally revealed more than one species in a sample that had been identified to a single species in the field (e. g., field identifications of *Eualus macilenta* were later found to also contain *E. gaimardii belcheri*). The counts and weights of the species in question were arbitrarily expanded from the laboratory species ratio to encompass the entire catch of the trawl.

After final identification, all invertebrates were assigned code numbers (Mueller 1975) to facilitate data analysis by computer. Representative and voucher samples of

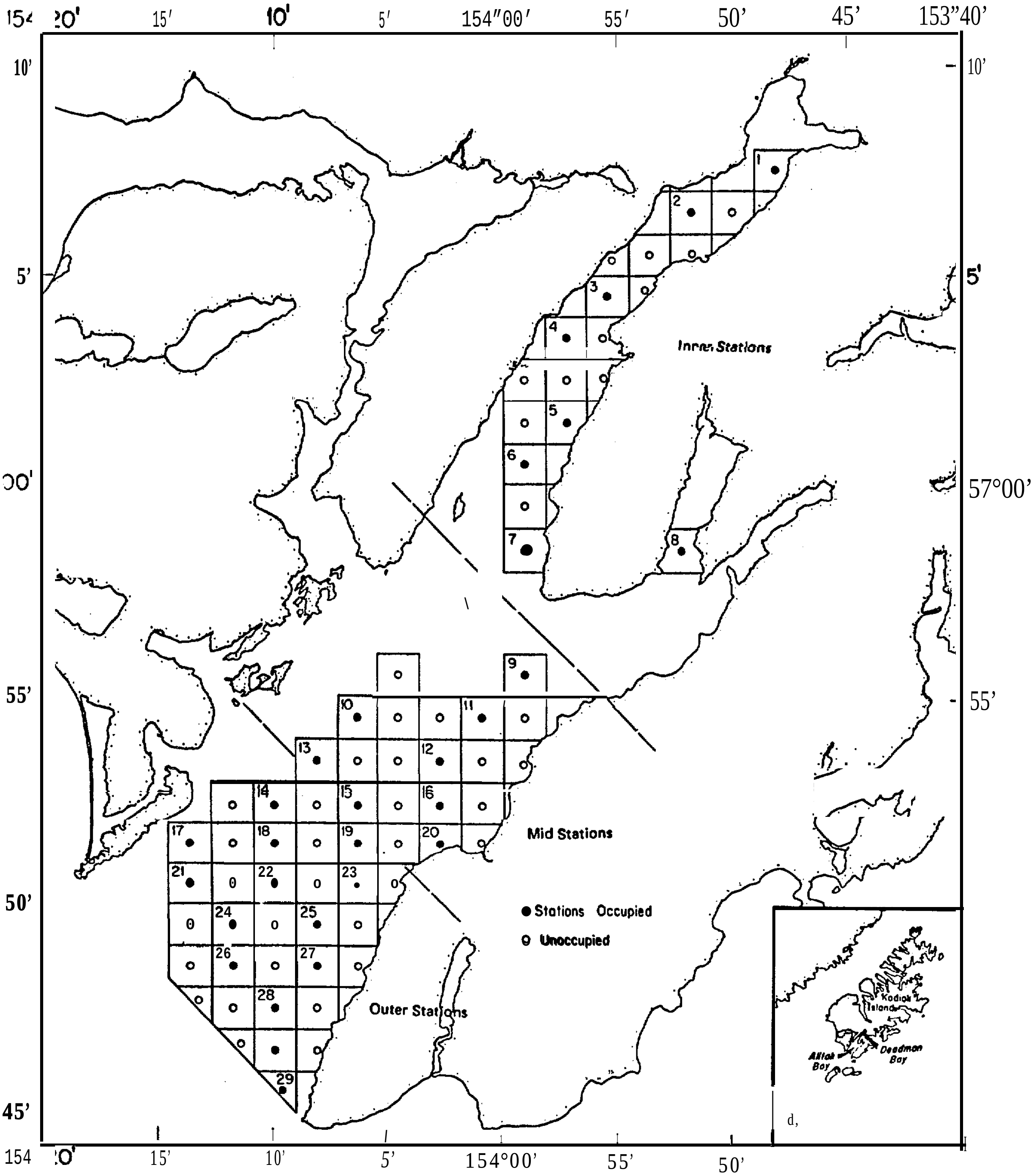

Figure 1.—Trawl station grid and stations occupied in Alitak Bay, Kodiak Island, Alaska, during June–August 1976 and March 1977. The oblique, dashed lines drawn across the bay divide it into three sections referred to in the text.

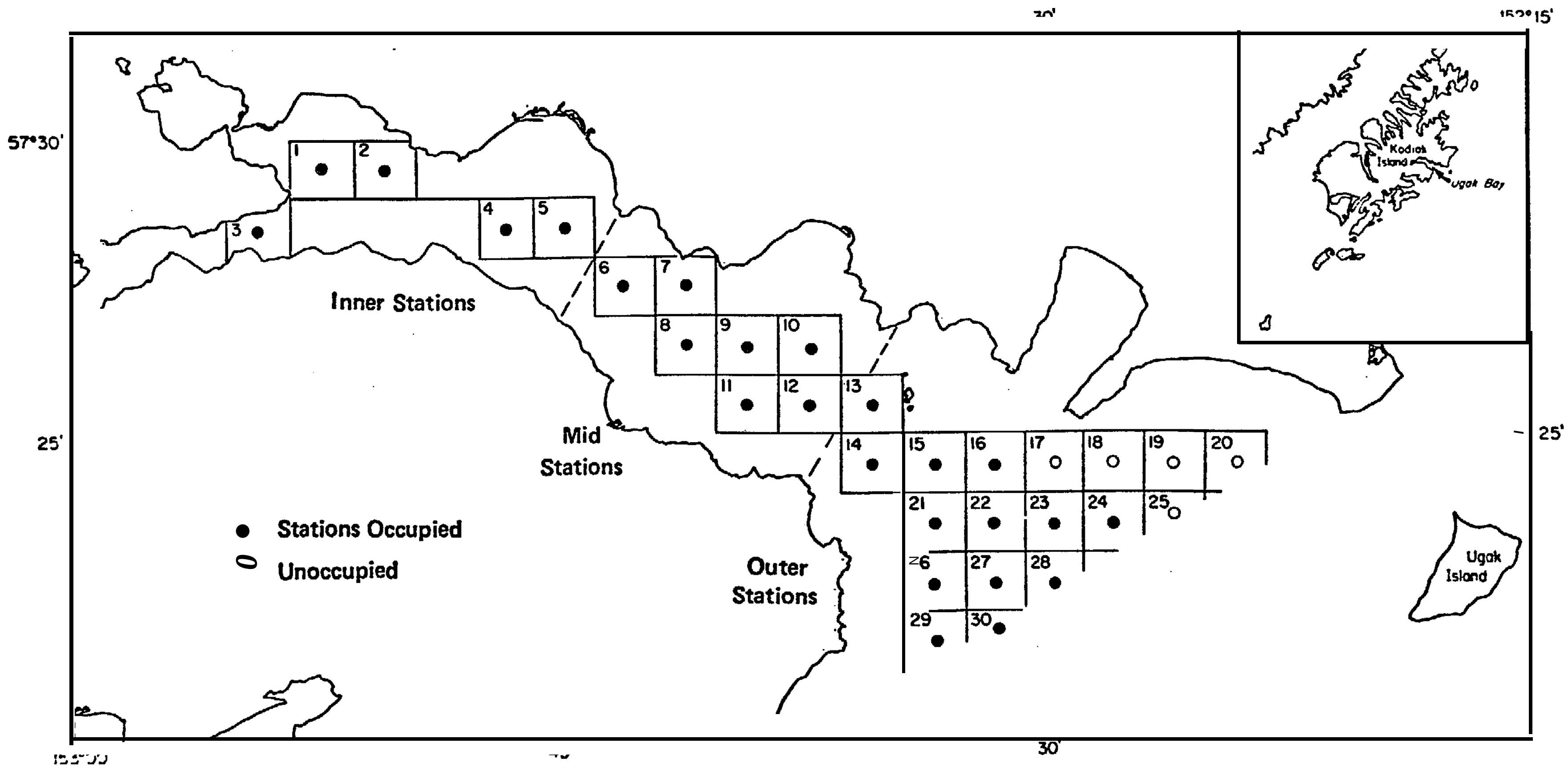

Figure 2.—Trawl station grid and stations occupied in Ugak Bay, Kodiak Island, Alaska, during June–August 1976 and March 1977. The oblique dashed lines drawn across the bay divide it into three sections referred to in the text.

invertebrates are temporarily stored at the Institute of Marine Science, University of Alaska, Fairbanks, Alaska.

The major limitation of the survey was that imposed by the selectivity of the otter trawl used. In addition, rocky-bottom areas could not be sampled since otter trawls of the type used can only be fished on relatively smooth bottoms. The location of stored commercial crab gear in Alitak Bay necessitated elimination of six stations (9 through 13) during the August sampling period; seven outer Alitak Bay stations (14, 18, 25–29) were eliminated in March 1977 due to heavy concentrations of ovigerous female king crabs.

Food data were collected by examining, either on board or in the laboratory, the stomachs of two species of crabs (*Chionoecetes bairdi* and *Paralithodes camtschatica*) and four species of flatfishes (*Limanda aspera, Platichthys stellatus, Hippoglossoides elassodon,* and *Lepidopsetta bilineata*). Male snow crabs (C. *bairdi*) between 85 and 180 mm carapace width and male king crabs (*P. camtschatica*) between 90 and 200 mm carapace length were examined. The importance of prey organisms in the diet is expressed as frequency of occurrence; i.e., the percentage of stomachs containing a particular food item.

King and snow crabs were separated by weight, sex, and state of maturity. Male king crabs were considered sexually mature if their wet weight was at least 2.0 kg. Male snow crabs were considered mature if their wet weight was at least 0.45 kg. Weight criteria established for maturity of both crab species are approximations based on the minimum weight of legal-size crabs (J. Hilsinger and S. Jewett, unpubl. data). Female king and snow crabs were classified as immature (pre-reproductive) or mature (reproductive or post-reproductive) based on the enlarged abdomen, modified pleopods, and egg clutch of the adults.

All station data not included in this report are on file at the National Oceanographic Data Center.

RESULTS

Distribution, Abundance, and Reproductive Biology

Alitak Bay

The average epifaunal invertebrate biomass for all Alitak Bay stations sampled was 6.24 g/m^2 (Table 1). The lowest biomass recorded was 3.17 g/m^2, in August 1976; the highest biomass was 10.59 g/m^2, in March 1977.

Taxonomic analysis of epifaunal invertebrates from Alitak Bay delineated 10 phyla, 16 classes, 46 families, 60 genera, and 79 species (Table 2 and Appendix Table 1). Arthropoda (Crustacea) and Mollusca dominated species representation with 34 and 22 species, respectively (Table 2 and Appendix Table 1). Arthropods accounted for 99.1% of the total invertebrate biomass (Table 3 and Appendix Table 2); 97.7% of this biomass was made up of the families Pandalidae, Lithodidae, and Majidae (Table 4 and Appendix Table 3). The leading species in each of these families, respectively, were the pink shrimp (*Pandalus borealis*), the king crab (*Paralithodes camtschatica*), and the snow crab (*Chionoecetes bairdi*) (Table 5 and Appendix Table 4). Although 22 species of Mollusca were represented, these species only accounted for 0.14% of the total invertebrate biomass (Table 3).

The average pink shrimp catch for all Alitak Bay stations in all sampling periods was 15.97 kg per tow (1,581.86 kg/99 tows; also see Table 5). Abundant catches of pink shrimp were obtained during June, July, and August 1976 from Alitak Bay stations 11-16 (Fig. 1). During March 1977 the largest catches came from stations 3-7 (Fig. 1). The largest single catch, 426.0 kg, was obtained in July at station 23.

Pink shrimp were not carrying eggs during June and July. However, in August, aqua-colored eggs were visible through the cephalothorax and/or were attached to the abdominal appendages. By the following March, the eggs had advanced to the eyed condition. Other pandalid and crangonid shrimps displayed similar timing of egg maturation.

The average king crab catch for all Alitak Bay tows was 44.10 kg per tow (4,365.87 kg/99 tows; also see Table 5). During June through August, Alitak Bay stations 21-29 had good catches. However, the largest catches were obtained in the outer stations during March 1977. Several 10-minute tows were made in this outer bay area, and these short tows produced full catches of adult female king crabs. Due to the high concentrations of these female crabs and the mortality which would probably result from continued sampling, trawling was discontinued in seven of the outer Alitak Bay stations.

Table 1. —Total epifaunal invertebrate biomass from benthic trawling activities in Alitak and Ugak bays, June-August and March 19’77.

	Alitak Bay			Ugak Bay			Alitak and Ugak bays		
	Weight (kg)	Distance fished (km)	Biomass (g/m^2)	Weight (kg)	Distance fished (km)	Biomass (g/m^2)	Weight (kg)	Distance fished (km)	Biomass (g/m^2)
Jun 1976	2,998,42’7	47.15	5.21	1,264.732	42.50	2.43	4,263.159	89.65	3.98
Jul 1976	3,313.600	45.30	5.99	2,086.509	43.46	3.93	5,400.110	88.76	4.98
Aug 1976	1,431.266	36.98	3.17	1,862.656	41.14	3.71	3,293.922	78.12	3.45
Mar 1977	3,939.625	30.49	10.59	1,900.674	37.90	4.11	5,840.300	68.39	6.99
All months	11,682.919	159.92	6.24	7,114.572	165.00	3.54	18,797.493	324.92	4.74

Table 2.—Species taken by trawl from Alitak Bay, June-August 1976 and March 1977.

Phylum Porifera
unidentified species

Phylum Cnidaria
Class Hydrozoa
unidentified species
Class Scyphozoa
unidentified species
Class Anthozoa
Family Pennatulidae
Ptilosarcus gurneyi (Gray)
Family Actinostolidae
Stomphia coccinea (O. F. Müller)
Family Actiniidae
Tealia crassicornis (O. F. Müller)

Phylum Annelida
Class Polychaeta
Family Polynoidae
unidentified species
Family Nereidae
Nereis sp.
Family Serpulidae
Crucigera irregulars Bush
Class Hirudinea
Family Acanthochitonidae
Notostomobdella SP.

Phylum Mollusca
Class Pelecypoda
Family Nuculonidae
Nuculana fossa Baird
Yoldia thraciaeformis Storer
Family Mytilidae
Mytilus edulis Linnaeus
Musculus discors (Gray)
Family Pectinidae
Chlamys rubida Hinds
Pecten caurinus Gould
Family Anomiidae
Pododesmus macrochisma Deshayes
Family Astartidae
Astarte rollandi Bernardi
Astarte esquimalti Baird
Family Cardiidae
Clinocardium ciliatum (Fabricius)
Serripes groenlandicus (Bruguiére)
Family Veneridae
Saxidomus gigantea (Deshayes)
Protothaca staminea (Conrad)
Family Tellinidae
Macoma calcarea (Gmelin)
Family Hiatellidae
Hiatella arctica (Linnaeus)

Phylum Mollusca (continued)
Class Gastropoda
Family Calyptraeidae
Crepidula numaria Gould
Family Velutinidae
Velutina sp.
Family Cymatiidae
Fusitriton oregonensis (Pedfield)
Family Thaididae
Nucella lamellosa (Gmelin)
Family Neptunidae
Neptunea lyrata (Gmelin)
Class Cephalopoda
Family Gonatidae
Gonatus sp.
Family Octopodidae
octopus Sp.

Phylum Arthropoda
Class Crustacea
Family Balanidae
Balanus balanus Pilsbury
Balanus hesperius Pilsbury
Balanus rostratus Pilsbury
Order Amphipoda
unidentified species
Order Decapoda
Family Pandalidae
Pandalus borealis Kröyer
Pandalus goniurus Stimpson
Pandalus hypsinotus Brandt
Pandalopsis dispar Rathbun
Family Hippolytidae
Eualus biunguis Rathbun
Eualus gaimardii belcheri (Bell)
Eualus macilenta (Kröyer)
Family Crangonidae
Crangon dalli Rathbun
Crangon communis Rathbun
Sclerocrangon boreas (Phipps)
Argis sp.
Argis lar (Owen)
Argis dentata (Rathbun)
Argis crassa Rathbun
Family Paguridae
Pagurus sp.
Pagurus ochotensis Brandt
Pagurus *aleuticus* (Benedict)
Pagurus capillatus (Benedict)
Pagurus kennerlyi (Stimpson)
Pagurus beringanus (Benedict)
Labidochirus splendescens (Owen)

Phylum Arthropoda (continued)
    Family Lithodidae
        Paralithodes camtschatica (Tilesius)
        Paralithodes platypus Brandt
    Family Majidae
        Oregonia gracilis Dana
        Hyas lyratus Dana
        Chionoecetes bairdi Rathbun
        Pugettia gracilis (Dana)
    Family Cancridae
        Cancer magister Dana
        Cancer oregonensis (Dana)
    Family Atelecyclidae
        Telmessus cheiragonus (Tilesius)

Phylum Sipunculida
        unidentified species

Phylum Ectoprocta
        unidentified species

Phylum Brachiopoda
  Class Articulate
    Family Dallinidae
        Terebratalia transversa (Sowerby)

Phylum Echinodermata
  Class Asteroidea
    Family Echinasteridae
        Henricia sp.
    Family Pterasteridae
        Pteraster tesselatus Fisher
    Family Asteridae
        Evasterias echinosoma (Stimpson)
        Evasterias troschelii (Stimpson)
        Stylasterias forreri (de Loriol)
        Pycnopodia helianthoides (Brandt)
    Family Strongylocentrotidae
        Strongylocentrotus droebachiensis (O. F. Müller)
  Class Holothuroidea
    Family Molpadiidae
        Molpadia sp.
    Family Cucumariidae
        Cucumaria sp.

Phylum Chordata
  Class Ascidiacea
        unidentified species

Table 3.—Number, weight, and density of major epifaunal invertebrate phyla of Alitak and Ugak bays, June–August 1976 and March 1977.

	Number of organisms		Weight (kg)		Percent of total weight		Mean grams per square meter	
Phylum	Alitak	Ugak	Alitak	Ugak	Alitak	Ugak	Alitak	Ugak
Porifera	649	1,037	43.86	89.35	0.38	1.25	0.022	0.044
Cnidaria	71	275	12.23	44.75	0.10	0.63	0.006	0.022
Mollusca	276	570	16.62	6.48	0.14	0.09	0.008	0.003
Arthropoda (Crustaceans only)	294,718	162,337	11,586.55	6,819.85	99.10	95.85	5.938	3.387
Echinodermata	77	577	22.62	137.36	0.19	1.93	0.011	0.068
Total	295,791	164,796	11,681.88	7,097.79	99.91	99.75	5.985	3.524

Table 4.—Number, weight, and density of major epifaunal invertebrate families of Alitak and Ugak bays, June-July 1976 and March 1977.

	Number of organisms		Weight (kg)		Percent of total weight		Mean grams per square meter	
Family	Alitak	Ugak	Alitak	Ugak	Alitak	Ugak	Alitak	Ugak
Actiniidae	32	249	8.31	43.26	0.07	0,60	0.004	0.021
Pandalidae	263,376	143,595	2,316.23	1,392.23	19.82	19.56	1.187	0.691
Hippolytidae	14,559	3,793	109.34	35.73	0.93	0.50	0.056	0.017
Lithodidae	3,013	3,460	4,366.32	2,586.71	37.37	36.35	2.237	1.285
Majidae	7,874	6,420	4,'731.85	2,743.04	40.50	38.55	2.425	1.362
Asteridae	52	197	21.41	130.03	0.18	1.82	0.010	0.064
Total	288,906	157,714	11,553.46	6,931.00	98.87	97.38	5.919	3.440

Table 5.—Number, weight, and density of major epifaunal species of Arthropoda (Crustacea) from Alitak and Ugak bays, June-August 1976 and March 1977.

Species	Number of organisms		Weight (kg)		Percent of total weight		Mean grams per square meter	
	Alitak	Ugak	Alitak	Ugak	Alitak	Ugak	Alitak	Ugak
Pandalus borealis	81,668	91,225	1,581.86	881.96	13.54	12.40	0.810	0.438
Pandalus goniurus	33,109	26,688	2’70.15	253.04	2.31	3.56	0.138	0.125
Pandalus hypsinotus	45,509	25,343	414.10	253.81	3.54	3.57	0.212	0.126
Pandalopsis dispar	3,089	338	50.54	3.41	0.43	0.05	0.025	0.001
Eualus gaimardii belcheri	11,288	—	81.96	—	0.70	—	0.042	—
Argis dentata	2,349	1,600	17.84	11.33	0.15	0.16	0.009	0.005
Paralithodes camtschatica	3,012	3,460	4,365.87	2,586.71	37.37	36.36	2.237	1.285
Chionoecetes bairdi	7,772	6,085	4,728.56	2,740.74	40.47	38.52	2.423	1.361
Total	187,796	154,739	11,510.88	6,731.00	98.51	94.62	5.896	3.341

Ovigerous king crabs were collected in each of the four sampling periods. Many egg clutches were partially hatched and approximately 3% were completely hatched by March. No grasping was observed at the latter time. Differences in sex composition and stage of maturity were observed over the four sampling periods (Tables 6 and 7). The sex ratio of king crabs at the outer Alitak Bay stations from this study and from other studies (Gray and Powell 1966; Kingsbury and James 1971) is presented in Table 8.

The average snow crab catch was 47.76 kg per tow (4,728.56 kg/99 tows; also see Table 5). Large catches of snow crabs were obtained at Alitak Bay stations 2-5 from June through August. The largest catch, 119.51 kg, was recorded at Alitak Bay station 3 in July. The catch of snow crabs in Alitak Bay declined from June to August; the catch was up slightly in March. Adult males were the main component of the population during the summer sampling periods (Table 6); adult females carrying eyed-eggs were common in March (Table 7). Ovigerous snow crabs were present during all four sampling periods.

Ugak Bay

The average epifaunal invertebrate biomass for all Ugak Bay stations sampled was 3.54 g/m^2 (Table 1). The lowest and highest biomasses were recorded in June 1976 and March 1977, respectively.

During the four Ugak Bay sampling periods, in which 98 tows were made, epifaunal invertebrates were identified to 12 phyla, 19 classes, 50 families, 67 genera, and 84 species (Table 9 and Appendix Table 5). Arthropoda and Mollusca dominated Ugak Bay in species representation with 30 and 22 species present, respectively (Table 9). Crustaceans accounted for 95.8% of the total invertebrate biomass (see Appendix Tables 6–8 for biomass data); 87.2% of the crustacean biomass consisted of pink shrimp and king and snow crabs (Table 5).

The average pink shrimp catch for 98 Ugak Bay tows was 9.0 kg per tow (881.96 kg/98 tows; Table 5). Large catches of pink shrimp were obtained from Ugak Bay stations 10–14, 22, and 23 (Fig. 2) during June-August 1976. During March 1977 the greatest pink shrimp catches came from stations 6–14 (Fig. 2). The reproductive state of pink shrimp in Ugak Bay was similar to that observed for Alitak Bay.

King crabs were not as common in Ugak Bay as in Alitak Bay. The average catch in Ugak Bay for all stations and all sampling periods was nearly half the average catch in Alitak Bay; i.e., 26.40 kg per tow in Ugak Bay (2,586.71 kg/98 tows; Table 5) as opposed to 44.10 kg per tow in Alitak Bay. During June–August, large catches were made at Ugak Bay stations 1-4; the largest catch was 99.88 kg in August at station 4.

Table 6.—Sex and maturity composition of king crabs and snow crabs in Alitak and Ugak bays, June-August 1976,

Alitak Bay Stations

Alitak Bay stations	Composition	June				July				August			
		King crab		Snow crab		King crab		Snow crab		King crab		Snow crab	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1-7	Adult males	o	0	1,148	98	0	0	653	97	3	30	41'7	95
(inner)	Adult females[1]	0	0	8	1	0	0	16	2	7	70	11	3
	Juvenile males	0	0	0	0	0	0	0	0	0	0	2	<1
	Juvenile females	0	0	8	1	0	0	6	1	0	0	9	2
	Total	0	0	1,164	100	0	0	675	100	10	100	439	100
9–13, 15[2], 16, 20 (mid-bay)	Adult males	0	0	603	88	41	67	895	92	6	15	84	92
	Adult females[1]	1	100	55	8	4	6	53	6	16	39	4	4
	Juvenile males	0	0	0	0	13	21	14	1	14	34	2	2
	Juvenile females	0	0	27	4	4	6	8	1	5	12	2	2
	Total	1	100	685	100	62	100	970	100	41	100	92	100
14, 17, 18, 19, 21-29 (outer)	Adult males	25	7	1,037	76	28	4	583	61	21	8	178	67
	Adult females[1]	165	50	319	23	244	35	271	28	100	37	69	26
	Juvenile males	87	26	8	1	236	34	12	1	92	34	9	3
	Juvenile females	56	17	4	<1	186	27	93	10	56	21	11	4
	Total	333	100	1,368	100	694	100	959	100	269	100	267	100

Table 6. —(Continued)

Ugak Bay Stations

Ugak Bay stations	Composition	June King crab No.	June King crab %	June Snow crab No.	June Snow crab %	July King crab No.	July King crab %	July Snow crab No.	July Snow crab %	August King crab No.	August King crab %	August Snow crab No.	August Snow crab %
1–5 (inner)	Adult males	8	7	180	87	23	2	214	42	20	5	190	77
	Adult females[1]	1	1	16	8	2	<1	59	12	5	1	19	8
	Juvenile males	43	38	0	0	397	43	196	38	193	50	18	7
	Juvenile females	61	54	11	5	511	55	42	8	169	44	21	8
	Total	113	100	207	100	933	100	511	100	387	100	248	100
6-12 (mid-bay)	Adult males	7	29	567	90	23	6	212	56	2	1	213	81
	Adult females[1]	3	13	31	5	9	2	33	9	1	1	8	3
	Juvenile males	12	50	0	0	189	50	109	29	76	45	25	10
	Juvenile females	2	8	35	5	159	42	25	6	88	53	16	6
	Total	24	100	633	100	380	100	379	100	167	100	262	100
13–30 (outer)	Adult males	21	29	591	83	21	8	728	62	2	<1	339	76
	Adult females[1]	7	10	38	5	36	13	61	5	9	1	23	5
	Juvenile males	29	40	0	0	149	53	189	16	379	57	59	14
	Juvenile females	15	21	79	12	73	26	200	17	282	42	24	5
	Total	72	100	708	100	279	100	1,178	100	672	100	445	100

[1] All adult female king and snow crabs in both bays were carrying eggs.
[2] Stations 9–13 in Alitak Bay were not sampled during August due to the presence of stored crab gear.

Table 7.—Sex and maturity composition of king crabs and snow crabs in Alitak and Ugak bays, March 1977.

Alitak Bay stations	Composition	King crab No.	King crab %	Snow crab No.	Snow crab %
1–7' (inner)	Adult males	1	50	99	51
	Adult females[1]	1	50	5	2
	Juvenile males	o	0	12	6
	Juvenile females	o	0	12	6
	Total	2	100	196	100
9-13, 15, 16, 17, 20 (mid-bay)	Adult males	66	24	109	29
	Adult females	184	67	36	9
	Juvenile males	22	8	146	39
	Juvenile females	2	1	88	23
	Total	274	100	379	100
19, 21–24 (outer)	Adult males	68	7	23	4
	Adult females	862	92	413	82
	Juvenile males	10	1	28	6
	Juvenile females	o	0	40	8
	Total	940	100	504	100
Ugak Bay stations					
1–5 (inner)	Adult males	o	0	94	27
	Adult females	13	12	48	14
	Juvenile males	37	33	190	55
	Juvenile females	61	55	14	4
	Total	111	100	346	100
6-12 (mid-bay)	Adult males	9	16	120	22
	Adult females	10	18	97	18
	Juvenile males	29	52	300	55
	Juvenile females	8	14	29	5
	Total	56	100	546	100
13-16, 21-23, 26–29 (outer)	Adult males	20	9	119	19
	Adult females	31	15	130	21
	Juvenile males	132	63	278	43
	Juvenile females	28	13	106	17
	Total	211	100	633	100

[1] All adult female king crabs and snow crabs in both bays were carrying eggs.

Table 8.—Sex ratios of king crabs in outer Alitak Bay.[1]

Date	Mature crabs			Immature crabs		
	Female	Male	Ratio[2]	Female	Male	Ratio[2]
Apr 1970[3]	1,440	421	3.42:1	77	60	1.28:1
May 1962[4]	584	366	1.60:1	21	28	0.75:1
Jun 1970[3]	359	198	1.81:1	66	103	0.64:1
Jun 1976	165	25	6.60:1	56	87	0.64:1
Jul 1976	244	28	8.71:1	186	236	0.79:1
Aug 1976	100	21	4.76:1	56	92	0.61:1
Mar 1977	1,047	135	7.76:1	2	32	0.06:1

[1] See Kingsbury et al. (1974) for data for months not reported here.
[2] Females per male.
[3] Kingsbury and James (1971).
[4] Gray and Powell (1966).

King crabs were well dispersed throughout Ugak Bay in all months. The catch during all sampling months was mainly juveniles (Tables 6 and 7). Ovigerous females were present in each of the four sampling periods. The king crab sex ratio in Ugak Bay is presented in Table 10. Seven grasping pairs were observed in March.

Snow crabs were usually dominant at all stations. Large catches were obtained at Ugak stations 9, 10, 13, and 22 during June through August. Station 9 had the largest catch, 89.08 kg, during March. The catch was composed mainly of adult males during June through August (Table 6). Ovigerous females and juvenile males and females were more common during March than June through August (Tables 6 and 7),

Table 9.—Species taken by trawl from Ugak Bay, June-August 1976 and March 1977.

Phylum Porifera
unidentified species

Phylum Cnidaria
Class Hydrozoa
Family Campanulariidae
Campanularia sp.
Family Lafoeidae
unidentified species
Family Sertulariidae
Sertularella sp.
Sertularia sp.
Abietinaria sp.
Family Plumulariidae
unidentified species
Class Scyphozoa
unidentified species
Class Anthozoa
Subclass Alcyonaria
Family Actinostolidae
Stomphia coccinea (O. F. Müller)
Family Actiniidae
Tealia crassicornis (O. F. Müller)

Phylum Ctenophora
unidentified species

Phylum Annelida
Class Polychaeta
Family Polynoidae
unidentified species
Family Spintheridae
Spinther alaskensis Hartman
Family Nereidae
Nereis sp.
Family Serpulidae
Crucigera irregulars Bush

Phylum Mollusca
Class Pelecypoda
Family Nuculanidae
Nuculana fossa Baird
Yoldia hyperborea Lovén in Torell
Family Mytilidae
Mytilus edulis Linnaeus
Musculus discors (Gray)
Modiolus modiolus (Linnaeus)
Family Pectinidae
Chlamys rubida Hinds
Pecten caurinus Gould

Phylum Mollusca (continued)
Family Cardiidae
Clinocardium ciliatum (Fabricius)
Clinocardium nuttallii Conrad
Serripes groenlandicus (Bruguiére)
Family Tellinidae
Macoma calcarea (Gmelin)
Macoma moesta (Deshayes)
Family Hiatellidae
Hiatella arctica (Linnaeus)
Family Teredinidae
Bankia sp.
Bankia setacea Tryon
Class Gastropoda
Family Calyptraeidae
Crepidula nummaria Gould
Family Velutinidae
Velutina sp.
Family Cymatiidae
Fusitriton oregonensis (Red field)
Family Thaididae
Nucella lamellosa (Gmelin)
Family Dorididae
unidentified species
Class Cephalopoda
Family Gonatidae
Gonatus sp.
Family Octopodidae
octopus sp.

Phylum Arthropoda
Class Crustacea
Family Balanidae
Balanus sp.
Balanus balanus Pilsbury
Order Isopoda
unidentified species
Order Decapoda
Family Pandalidae
Pandalus borealis Kröyer
Pandalus goniurus Stimpson
Pandalus hypsinotus Brandt
Pandalopsis dispar Rathbun
Family Hippolytidae
Eualus biunguis Rathbun
Eualus macilenta (Kröyer)
Family Crangonidae
Crangon dalli Rathbun
Crangon communis Rathbun
Argis sp.
Argis lar (Owen)
Argis *dentata* (Rathbun)

Phylum Arthropoda (continued)
Family Paguridae
Pagurus ochotensis Brandt
Pagurus aleuticus (Benedict)
Pagurus capillatus (Benedict)
Pagurus kennerlyi (Stimpson)
Pagurus beringanus (Benedict)
Elassochirus tenuimanus (Dana)
Family Lithodidae
Paralithodes camtschatica (Tilesius)
Family Majidae
Oregonia gracilis Dana
Hyas lyratus Dana
Chionoecetes bairdi Rathbun
Pugettia gracilis (Dana)
Family Cancridae
Cancer sp.
Cancer *magister* Dana
Cancer oregonensis (Dana)
Family Atelecyclidae
Telmessus cheiragonus (Tilesius)
Family Pinnotheridae
Pinnixa occidentalis Rathbun

Phylum Sipunculida
unidentified species

Phylum Echiurida
Class Echiuroidea
Family Echiuridae
Echiurus echiurus Fisher

Phylum Ectoprocta
Class Cheilostomata
Family Flustridae
unidentified species
Family Microporidae
Microporina sp.
Class Ctenostomata
Family Flustrellidae
Flustrella sp.

Phylum Brachiopoda
Class Articulate
Family Cancellothridae
Terebratulina unguicula Carpenter
Family Dallinidae
Terebratalia transversa (Sowerby)

Table 9. —(continued)

Phylum Echinodermata
Class Asteroidea
Family Solasteridae
Solaster stimpsoni Verrill
Family Asteridae
Evasterias echinosoma (Stimpson)
Evasterias troschelii (Stimpson)
Stylasterias forreri (de Loriol)
Pycnopodia helianthoides (Brandt)
Family Strongylocentrotidae
Strongylocentrotus droebachiensis (O. F. Müller)
Class Ophiuroidea
Family Gorgonocephalidae
Gorgonocephalus caryi (Lyman)
Family Ophiactidae
Ophiopholis aculeata (Linnaeus)
Class Holothuroidea
Family Cucumariidae
Cucumaria sp.
Phylum Chordata
Class Ascidiacea
Family Styelidae
Pelonaia corrugata Forbes Goods

Table 10.—Sex ratios of king crabs in Ugak Bay.

	Mature crabs			Immature crabs		
Date	Female	Male	Ratio[1]	Female	Male	Ratio[1]
Jun 1976	11	36	0.31:1	78	84	0.93:1
Jul 1976	47	67	0.70:1	743	735	1.01:1
Aug 1976	15	24	0.63:1	539	648	0.83:1
Mar 1977	54	29	1.86:1	97	198	0.49:1

[1] Females per male.

Feeding Data

King crab, snow crab, and yellowfin sole (*Limanda aspera*) stomach contents are listed in Table 11. King crabs from Alitak and Ugak bays fed almost exclusively on molluscs, crustaceans, and unidentified fishes. Snow crabs fed primarily on polychaetes, clams, and unidentified fishes. Sediment and plant material were also frequently present in snow crab stomachs.

Clams and fishes were the main organisms consumed by yellowfin sole. Flathead sole (*Hippoglossoides elassodon*) fed on euphausiids and caridean shrimps (five fish examined), and rock sole (*Lepidopsetta bilineata*) fed primarily on polychaetes and the clam *Nuculana fossa* (four fish examined). Of the 40 yellowfin sole stomachs examined in March (Alitak Bay), 38 were empty. The stomachs of 27 starry flounder (*Platichthys stellatus*) examined in March were also found to be empty.

The Kodiak Island food web shown in Figure 3 is based on data from this study, McDonald and Peterson (1976), Feder et al. (1977), and Jewett (1977). The food web is presented so that carbon flow is generally from bottom to top and always in the direction of the arrows. Data were insufficient to clearly identify major food pathways. Polychaetes, gastropods (snails), pelecypods (clams), amphipods, anomurans (hermit crabs), brachyurans (true crabs), and carideans (shrimps) are the major invertebrate food items in the web. Shrimps and crabs are important food items for most fishes as well as some of the crabs. Small fishes such as herring (*Clupea harengus pallasi*), capelin (*Mallotus villosus*), and sand lance (*Ammodytes hexapterus*) are important as food for larger predatory fishes such as Pacific cod (*Gadus macrocephalus*), king salmon (*Oncorhynchus tshawytscha*), and halibut (*Hippoglossus stenolepis*). (See Feder et al. [1977] for additional Gulf of Alaska food data.)

Feeding relationships for snow crabs, king crabs, and Pacific cod (data from Feder et al. 1977, Jewett 1977) are shown in more detail in Figures 4, 5, and 6, respectively. Snow and king crabs feed heavily on benthic animals that, in turn, rely in whole or in part on detritus, bacteria, benthic diatoms, and meiofauna for food (Figs. 5 and 6). Pacific cod feed primarily on animals that feed on small benthic invertebrates or scavenged animal remains (Fig. 6 and Table 12). The invertebrates in the two bays relied on a variety of feeding methods while the fishes tended to be predators (Table 12).

Number, weight, and frequency of occurrence calculations used in this report are based on Appendix Tables 1-8.

Table 11.—Percent frequency of occurrence of food items found in stomachs of king and snow crabs and yellowfin sole from Alitak and Ugak bays, June–August 1976 and March 1977.

	Percent frequency of occurrence of food items found in stomachs of:					
	King crab		Snow crab		Yellowfin sole	
Food item	Alitak N = 37	Ugak N = 10	Alitak N=34	Ugak N=36	Alitak N=45	Ugak N=12
Polychaeta	—	—	23.5	5.6	—	—
Nuculanidae	5.4	20.0	2.9	13.9	—	—
Nuculana fossa	13.5	20.0	—	—	—	—
Pelecypoda	10.8	30.0	26.5	27.8	6.7	—
Macoma sp.	—	—	—	—	2.2	—
Tellina sp.	—	—	—	2.8	—	—
Spisula polynyma	2.7	—	—	—	2.2	—
Siliqua alta	—	—	—	—	2.2	—
Mytilus edulis	—	—	—	2.8	—	—
Gastropoda	5.4	10.0	—	—	—	—
Margarites sp.	5.4	—	—	—	—	—
Fusitriton oregonensis	2.7	—	—	—	—	—
Octopi	—	—	—	—	4.4	—
Crustacea	2.7	—	—	5.6	—	—
Euphausiacea	2.7	—	—	—	—	—
Caridea	10.8	—	20.6	11.1	—	—
Crangonidae	—	—	—	2.8	—	—
Brachyura	—	—	2.9	13.9	—	—
Majidae	—	10.0	—	—	—	—
Chionoecetes bairdi	—	—	—	—	4.4	—
Atelecyclidae	2.7	—	—	—	—	—
Pisces	18.9	20.0	8.8	5.6	—	25.0
Stichaeidae	—	—	—	—	2.2	—
Osmeridae	—	—	—	—	—	8.3
Mallotus villosus	—	—	—	—	2.2	—
Unidentified plants	5.4	10.0	38.2	22.2	—	—
Sediment	—	—	55.9	27.8	—	—
Unidentified remains	—	—	2.9	—	—	—
Empty stomachs	32.4	30.0	11.8	30.6	84.4	58.3

Table 12.—Feeding methods' of organisms included in the Kodiak Island (Alitak and Ugak bays and other inshore waters) food web.

Phylum abbreviations: A = Annelida; M = Mollusca; Art = Arthropoda; Ecd = Echinodermata
Ctn = Chaetognatha; Cho = Chordata; x = dominant feeding method; o = other feeding method

Organism	Phylum	Deposit feeder	Suspension feeder	Scavenger	Predator	Unknown
Polychaeta	A	x	x	x	x	—
Gastropoda	M	x	—	x	x	—
Margaritas	M	—	—	—	·	x
Fusitriton oregonensis	M	—		x	x	—
Nuculana fossa	M	x		—	—	—
Yoldia sp.	M	x	—			—
Spisula polynyma	M	—	x	—		—
Axinopsida sp.	M	—	—	—		x
Siliqua alta	M	—	—			x
Macoma sp.	M	x	o	—	—	—
Cephalopod	M	—	—	x	x	—
Mysidacea	Art	—	x	x	x	—
Amphipoda	Art	x	—	x	x	—
Euphausiacea	Art	—	x	—	—	—
Pandalidae	Art		—	x	x	—
Pandalus borealis	Art	—	·	x	x	—
Crangonidae	Art			x	x	—
Paguridae	Art			x	x	—
Paralithodes camtschatica	Art			x	x	—
Majidae	Art	—	—	x	x	—
Hyas lyratus	Art			x	x	—
Chionoecetes bairdi	Art			x	x	—
Atelecyclidae	Art	—	—	—	—	x
Ophiuroidea	Ecd	x	x	x	x	—
Chaetognatha	Ctn	—	—	—	x	—
Clupea harengus pallasi (herring)	Cho			—	x	—

Table 12. —(continued)

Organism	Phylum	Deposit feeder	Suspension feeder	Scavenger	Predator	Unknown
Oncorhynchus gorbuscha (pink salmon)	Cho	—	—	—	x	—
O. *keta* (chum salmon)	Cho	—	—	—	x	—
O. *kisutch* (coho salmon)	Cho	—	—	—	x	—
O. *nerka* (red salmon)	Cho	—	—	—	x	—
O. *tshawytscha* (king salmon)	Cho	—	—	—	x	—
Osmeridae	Cho	—	—	—	x	—
Mallotus villosus (capelin)	Cho	—	—	—	x	—
Theragra chalcogramma (pollock)	Cho	—	—	—	x	—
Gadus macrocephalus (Pacific cod)	Cho	—	—	x	x	—
Lyconectes sp.	Cho	—	—	—	x	—
Ammodytes sp. (sand lance)	Cho	—	—	—	x	—
Scorpaenidae	Cho	—	—	—	x	—
Ophiodon SP. (lingcod)	Cho	—	—	—	x	—
Cottidae	Cho	—	—	—	x	—
Atheresthes stomias (arrowtooth flounder)	Cho	—	—	—	x	—
Hippoglossoides ellasodon (flathead sole)	Cho	—	—	—	x	—
Hippoglossus stenolepis (Pacific halibut)	Cho	—	—	—	x	—
Lepidopsetta bilineata (rock sole)	Cho	—	—	—	x	—
Limanda aspera (yellowfin sole)	Cho	—	—	—	x	—
Platichthys stellatus (starry flounder)	Cho	—	—	—	x	—

[1] Barnes 1968; Feder unpubl. data; Hart 1973; Newell 1970; Pearce and Thorson 1967; Rasmussen 1973.

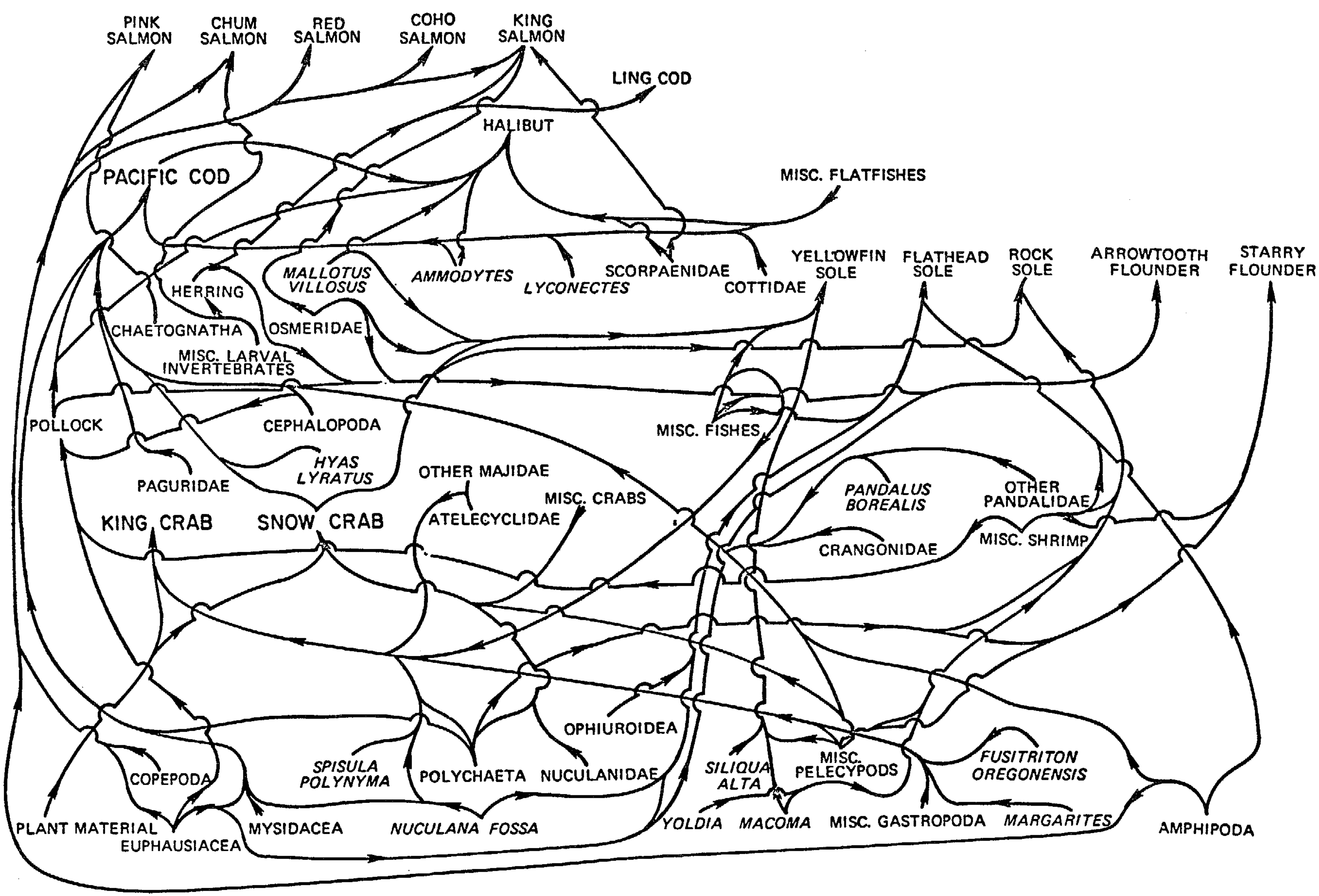

Figure 3.—Food web based on the epibenthic species taken from Alitak and Ugak bays and inshore waters around Kodiak Island, Alaska.

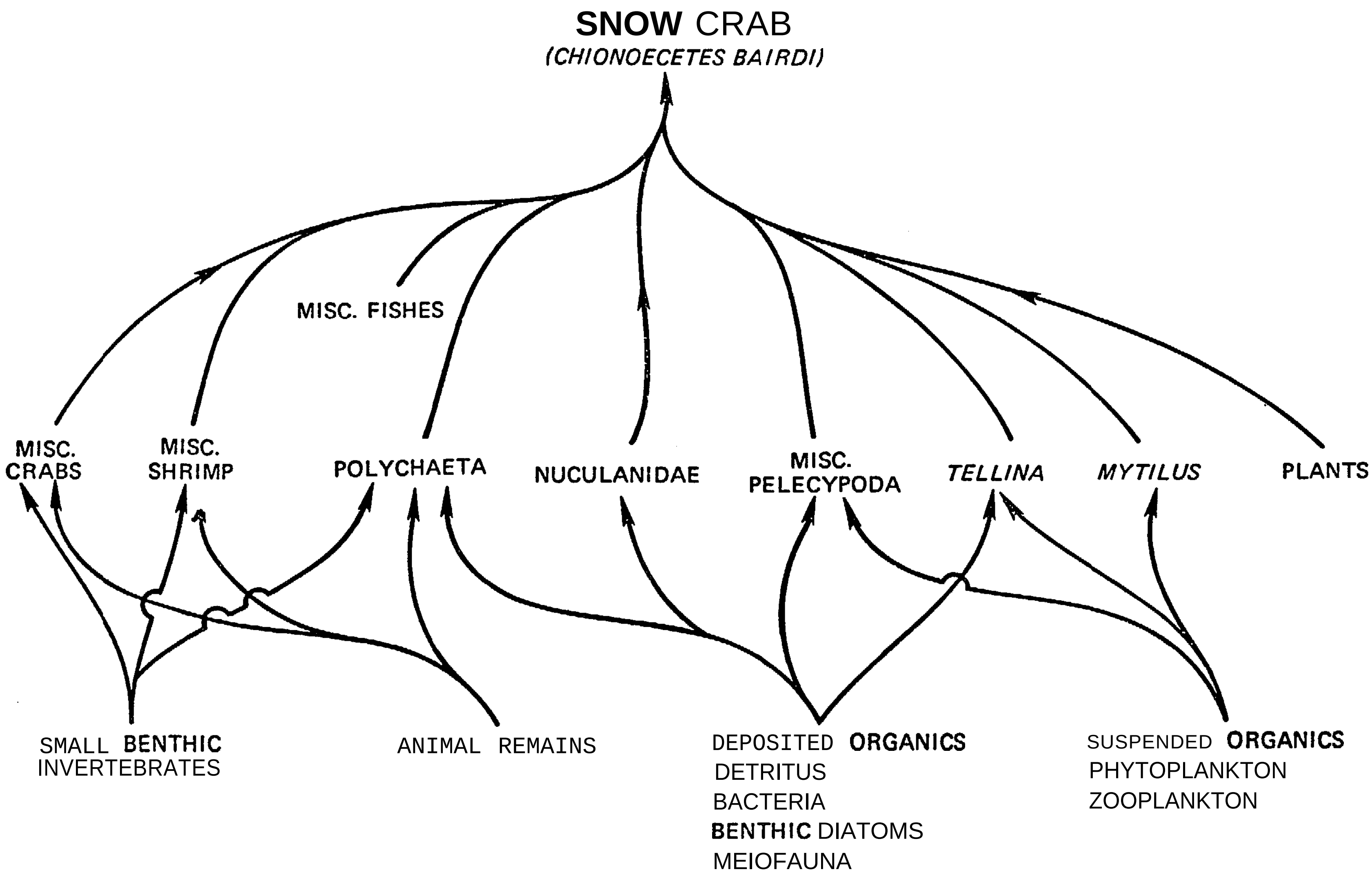

Figure 4.—Foodweb for the snow crab (*Chionoecetes bairdi*) in Alitak and Ugak bays and inshore waters around Kodiak Island, Alaska.

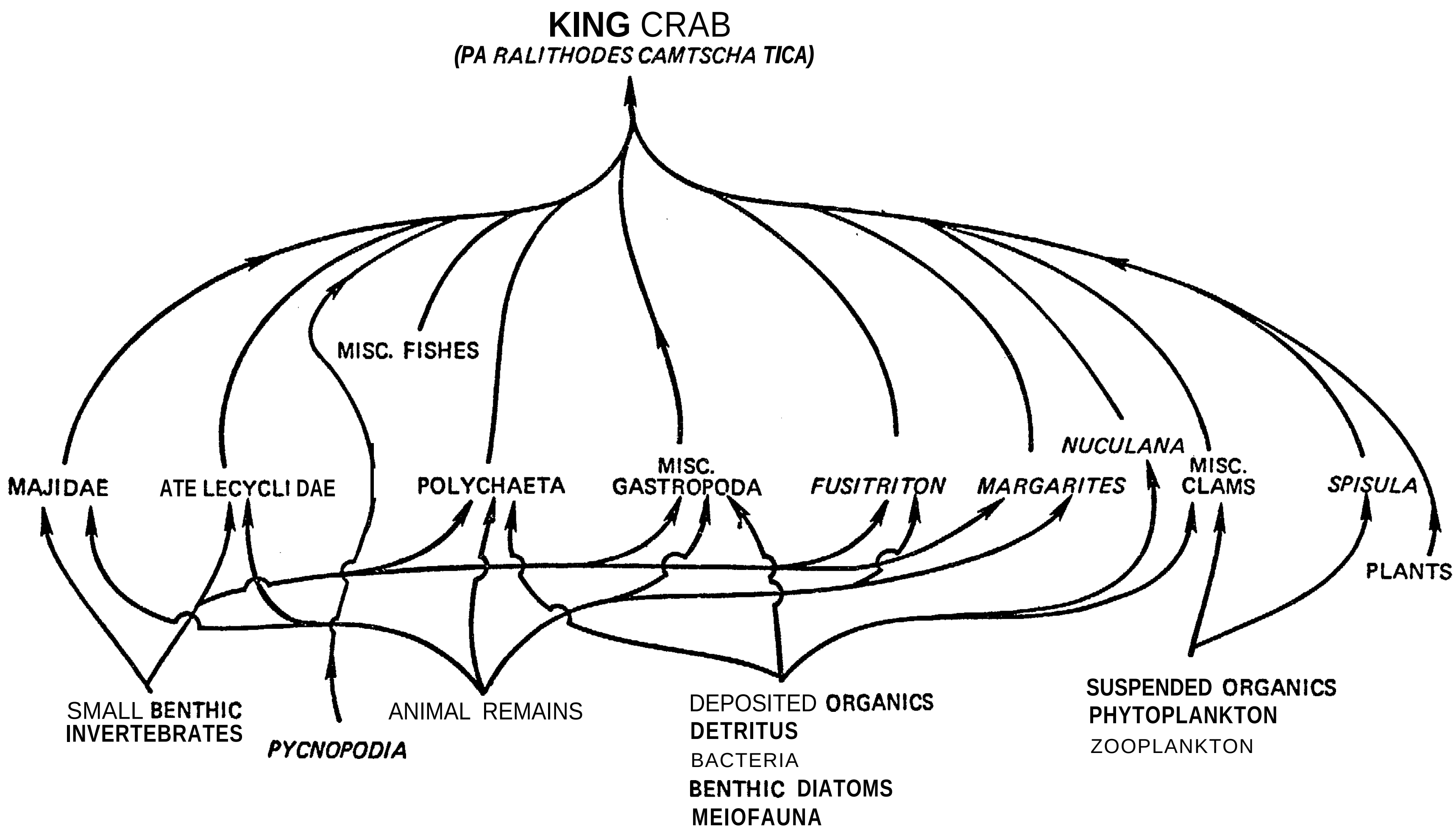

Figure 5—Food web for the king crab (*Paralithodes camtschatica*) in Alitak and Ugak bays and inshore waters around Kodiak Island, Alaska.

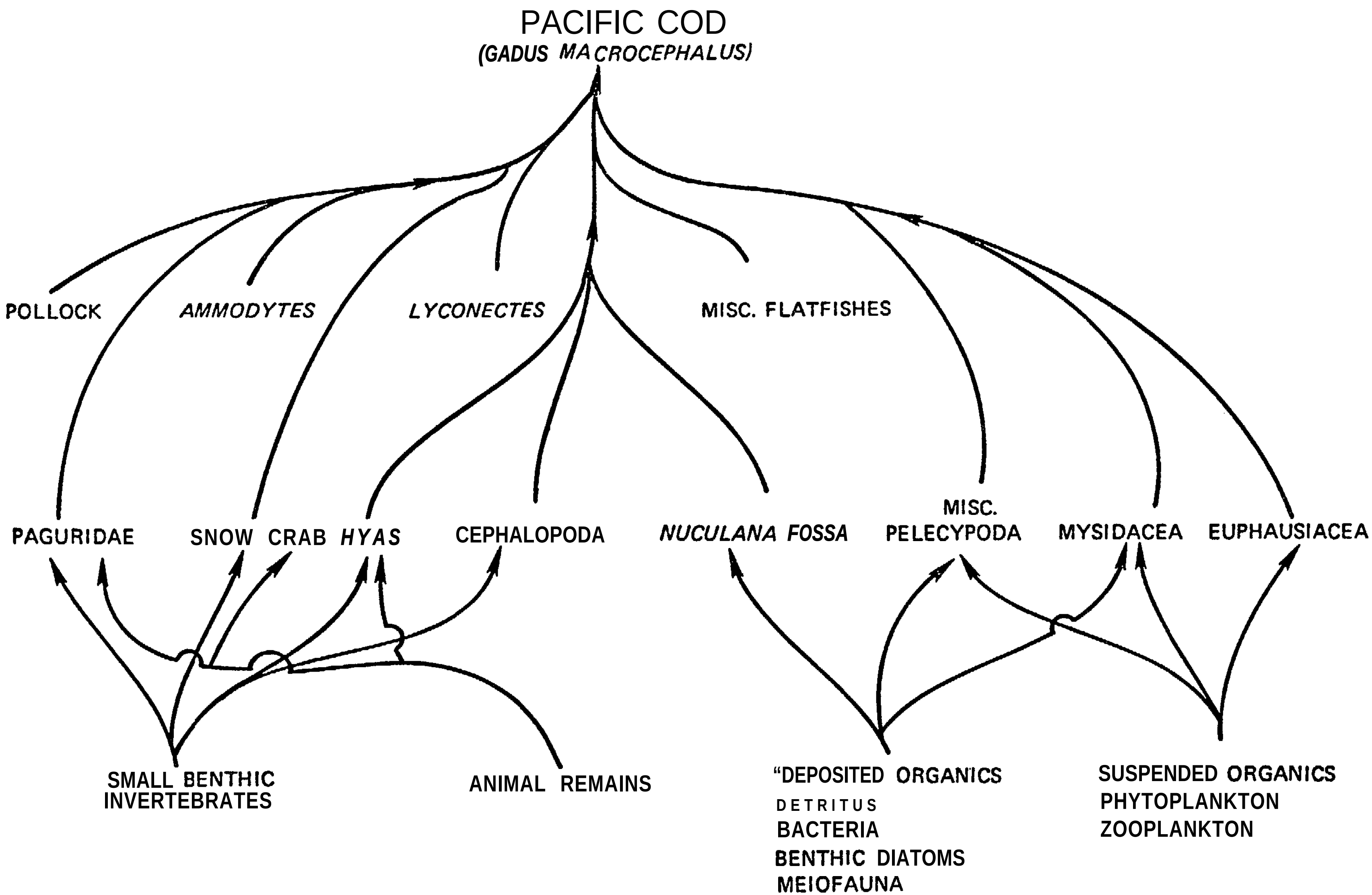

Figure 6. —Food web for the Pacific cod (*Gadus macrocephalus*) from inshore waters around Kodiak Island, Alaska. (Also see Jewett [1977] for comments on cod food habits in the Gulf of Alaska.)

DISCUSSION

Station Coverage

The trawl program discussed in this report represents the first intensive coverage of epifaunal invertebrates of Alitak and Ugak bays. Preliminary plans called for 28 stations to be occupied monthly in Alitak Bay and 25 stations in Ugak Bay for June, July, and August 1976, and March 1977. August sampling in Alitak Bay was hampered when stored crab gear prevented sampling of five stations. Seven outer Alitak Bay stations were eliminated in March 1977 due to high concentrations of ovigerous king crabs. During the four sampling periods, 99 stations were occupied in Alitak Bay and covered a total of 1.99 km^2. Station coverage in the 98 Ugak Bay stations totalled 2.03 km^2. The average distance fished at each station was 1.86 km.

Biomass

The epifaunal standing stock reported in the present study is similar to standing stock estimates reported in other OCSEAP benthic trawl studies (Jewett and Feder 1976; Feder et al. 1977). The total biomass of epifaunal invertebrates of the northeast Gulf of Alaska was 2.6 g/m^2 (Jewett and Feder 1976). The biomass determined for epifaunal invertebrates in the southeast Bering Sea was 3.3 g/m^2 in 1975 and 5.0 g/m^2 in 1976 (Feder et al. 1977). The average epifaunal biomass for Alitak and Ugak bays during all sampling months was 4.74 g/m^2 (Table 1).

Russian benthic investigations (Neyman 1963) provide biomass estimates based on grab samples for infauna and small epifauna from the southeast Bering Sea, with the lowest value reported as 55 g/m^2. Use of a commercial trawl results in the loss of infaunal and small epifaunal organisms that are an important part of the benthic biomass. Therefore, the total benthic biomass value is probably best expressed by combining both grab and trawl values. Combined infaunal and epifaunal surveys should be part of all future investigations designed by OCSEAP.

Species Composition and Diversity

Examination of the species composition of both bays revealed crustaceans and molluscs to be the major epifaunal invertebrates present. In general, epif aunal diversity was similar to that reported by Feder et al. (1976) and Jewett and Feder (1976) for the northeast Gulf of Alaska. The major differences between the northeast Gulf of Alaska and Kodiak fauna were the low numbers of species of annelids and echinoderms found in the Kodiak bays. The survey in the northeast Gulf of Alaska revealed 30 species of Annelida and 36 species of Echinodermata; however, these phyla in Alitak and Ugak bays only comprised 5 and 12 species, respectively. Hermit crabs (*Pagurus*) were the most diverse genus present, with six species collected (Tables 2 and 9).

King crabs live most of their lives on the deeper part of the continental shelf, coming into shallow water once a year to mate. Except during the mating season (mid-March to June), the sexes remain segregated in deeper water (Iverson 1966). Changing physical conditions from year to year may alter the periodicity of migration and breeding. The documented life history of king crabs reported elsewhere is reflected in the observations made on this crab in the Kodiak bays discussed in this report. Examination of sex composition and stage of maturity of king crabs from past and present studies in outer Alitak Bay indicates a high ratio of adult females to adult males during the mating season (Tables 6-8). The low numbers of adult male king crabs in Alitak Bay during the summer months probably reflect their departure following spawning. The migratory pattern of king crabs in Ugak Bay was not clearly defined during the study period. Segregation between sexes in juveniles is not apparent (Tables 6-8; Powell and Nickerson 1965).

Catches of king and snow crabs in Ugak Bay during the present study reflect a sex-maturity composition similar to that found during the Alaska Department of Fish and Game crab indexing studies in this bay; i.e., a predominance of juvenile king crabs of both sexes and adult male snow crabs from June through August (ADF&G, unpubl. data). Juvenile male and female king crabs and juvenile snow crabs were most common in March. Although Ugak Bay does not typically yield commercial-size king crabs, the outer bay is often fished for snow crabs (ADF&G, Kodiak, Alaska, snow crab catch statistics).

Food Habits

Chionoecetes bairdi and *Paralithodes camtschatica*, the main species examined for stomach contents in this study, were the most abundant and widely dispersed organisms present.

Inferences from this study, as well as other snow crab food data (Yasuda 1967; Feder et al. 1977; Feder, unpubl. data from Prince William Sound) concerning prey species, suggest that snow crab prey are area specific. Most of the important food items consumed by Alitak Bay and Ugak Bay snow crabs (i.e., polychaetes, clams, shrimps, plants, sediment) differed from food items used by snow crabs in Cook Inlet. Feder et al. (1977) examined 715 snow crabs in Cook Inlet and found that the main food items, in order of decreasing percent frequency of occurrence, were *Macoma* SPP. (clams), *Pagurus* SPP. (hermit crab), *Balanus* spp. (barnacles), and sediment. The only similar stomach items in the present study were clams and sediment. The role of sediment in crab feeding is not known. However, Moriarty (197'7) reported on the occurrence of sediment in the food contents of five species of penaeid shrimps. The nutritional benefit of sediment intake to these shrimps appears to be derived from the film of organic carbon, inclusive of bacteria, on sand grains. Yasuda (1967) found benthic diatoms to be abundant in *Chionoecetes opilio elongatus* in the Bering Sea, and postulated that diatoms were taken indirectly with food and sediment.

King crab diets appear to be similar at different geographic locations. McLaughlin and Hebard (1961) found molluscs to be the most frequently consumed food group (69.0%) in Bering Sea king crabs (with pelecypods more frequent than gastropod). Echinoderms ranked second, appearing in 42.2% of the crabs. Takeuchi (1959, 1967) examined the stomach contents of king crabs from the west coast of Kamchatka, and found molluscs (primarily pelecypods) to be the dominant food group. Crustaceans and echinoderms were the second and third most important groups, respectively. Bering Sea king crabs examined by Feder et al. (1977) also showed pelecypod molluscs to be the dominant food, specifically *Clinocardium* sp. and *Nuculana* sp. *Nuculana*, *a* deposit feeder, is the most frequently occurring food used by king crabs at Alitak and Ugak bays. Gastropod and shrimps were food items of secondary importance in the present study. Although echinoderms were absent from the 46 king crabs examined, sand dollars (*Dendraster* sp.) are occasionally consumed by king crabs occupying the outer continental shelf between Alitak and Ugak bays (G. C. Powell, ADF&G, pers. comm.).

King crabs and snow crabs, the two commercially important animals of great abundance near Kodiak Island, feed on a wide variety of organisms. The king crab, with its large claws, takes snails, clams, and fishes, while the snow crab with its long, thin, curved claws, is better able to remove plant material, polychaetes, shrimps, and small clams from the bottom. Postlarval stages of king crabs were not preyed upon by any of the fishes examined. However, the soft-shelled stage of the king crab is probably preyed upon since soft-shelled snow crabs are known prey of octopus and sea stars (J. Hilsinger, unpubl. data). Juvenile snow crabs are major prey of Pacific cod (*Gadus macrocephalus*) on the Kodiak continental shelf (Jewett 1977).

The use of deposit-feeding animals as food, as well as the consistent uptake of sediment, by king and snow crabs in the Kodiak area maybe critical in the event of oil contamination of sediments on crab feeding grounds.

CONCLUSIONS

There is now a satisfactory knowledge, on a station basis and for the months sampled, of the distribution and abundance of the major epifaunal invertebrates of the two study bays. Twelve phyla are represented in the collection. The important groups, in terms of species representation, in descending order of importance are the Arthropoda (Crustacean), Mollusca, Echinodermata, and Annelida. The latter three groups only accounted for less than 1.0% of the biomass collected in each bay, while Arthropoda accounted for 95.8% and 99.1 % of the biomass in Ugak Bay and Alitak Bay, respectively.

Additional seasonal data are essential. Only when such continuing information is available can a reasonable biological assessment of the effect of an oil spill on these bays be made.

Differences in sex composition and stage of maturity of king and snow crabs between and within the two bays were evident. Throughout the sampling period in Alitak Bay, king crabs occurred mainly at the outer stations and consisted primarily of egg-bearing females and juveniles of both sexes. King crabs were well dispersed throughout Ugak Bay during this period, and consisted mainly of juveniles. Snow crabs in Alitak Bay were primarily juveniles, while mainly adult males inhabited Ugak Bay. Life history data for these crabs for March, June, July, and August are now available.

Preliminary feeding data for the most common epifaunal species of the two bays are presented in this report. Of special importance are the food data compiled for snow crabs and king crabs, the two commercially important crabs of the Kodiak area. These data in conjunction with similar data compiled for these crabs in Cook Inlet and the Bering Sea (Feder et al. 1977) should contribute to an understanding of the trophic role of the crabs in their respective ecosystems and the impact of oil on crab-dominated systems such as those found in Alitak and Ugak bays.

The importance of deposit-feeding clams in the diet of king and snow crabs is demonstrated for the two bays; this situation" is also true for crabs observed elsewhere. A high probability exists that oil hydrocrabons will enter crabs via these deposit-feeding molluscs, suggesting that studies interrelating sediment, oil, deposit-feeding clams, and crabs should be initiated soon.

Sampling crabs and fishes using trawls and stomach analysis has made it possible to understand a major component (the epifauna) of two Kodiak bays. However, a full comprehension of the benthic system there will only be achieved when these studies are expanded to include an assessment of infauna as well. Data available suggest that adequate numbers of unique, abundant, and/or large species are available to permit nomination of likely monitoring candidates. Presumably, a monitoring program would be based primarily on recruitment, growth, food habits, and reproduction of the chosen species.

NEEDS FOR FURTHER STUDY

(1) Although the trawling activities were satisfactory for determination of the distribution and abundance of epifauna, a substantial component of both bays—the infauna—was not sampled, Since infaunal species represent important food items, it is essential that dredging be accomplished at the bay stations in the near future.

(2) The present study has produced a data base describing the abundance, density, and distribution of epibenthic invertebrates as well as notes on reproductive biology of commercially important crabs during June, July, and August 1976 and March 1977. Additional studies are needed during other seasons and years to describe seasonal and year-to-year variations in the distribution and relative abundance of the epifauna.

(3) Seasonal predator-prey relationships should be examined in conjunction with simultaneous infaunal sampling.

(4) It is essential that large samples of the dominant clam prey species be obtained to initiate recruitment, age, growth, and mortality studies. These data will then be comparable to similar data being collected for clams of Cook Inlet and the Bering Sea (Feder et al. 1977). Any future modeling efforts concerned with carbon or energy flow in the Kodiak area will need this type of information.

(5) No physical, chemical, and sediment data are currently available. This information should be obtained in the future in conjunction with all biological sampling efforts.

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APPENDIX

The following Appendix tables are taken from computer printouts of OCSEAP data submitted to the National Oceanographic Data Center.

Appendix Table 1

OCCURRENCE OF EACH SPECIES IN ALITAK BAY - JUNE, JULY, AND AUGUST 1976, AND MARCH 1977

A total of 99 stations were occupied. Taxonomic names represent the lowest level of identification.

Taxonomic name	Cumulative occurrence	% of all[1] occurrence	% of all[2] stations
Porifera	20	2.632	20.619
Hydrozoa	3	0.395	3.093
Scyphozoa	1	0.132	10031
Ptilosarcus gurneyi	8	1.053	8.247
Stomphia coccinea	1	0.132	1.031
Actiniidae	7	0.921	7.216
Tealia crassicornis	1	0.132	1.031
Polychaeta	1	0.132	1.031
Polynoidae	1	0.132	1.031
Nereis sp.	2	0.263	2,062
Crucigera irregularis	1	0.132	1.031
Hirudinea	1	0.132	1.031
Notostomobdella sp.	8	1*053	8.247
Nuculana fossa	5	0.658	5.155
Yoldia thraciaeformis	1	0.132	1.031
Mytilus edulis	1	0.132	1.031
Musculus discors	3	0.395	3.093
Chlamys rubida	4	0.526	4.124
Pecten caurinus	1	0.132	1.031
Pododesmus macrochisma	1	0.132	1.031
Astarte rollandi	1	0.132	1.031
Astarte esquimalti	1	0.132	1.031
Clinocardium ciliatum	1	0.132	1.031
Serripes groenlandicus	2	0.263	2.062
Saxidomus gigantea	1	0.132	1.031
Protothaca staminea	1	0.132	1.031
Macoma calcarea	5	0.658	5.155
Hiatella arctica	6	0.789	6.186

Appendix Table 1 (continued)

Taxonomic name	Cumulative occurrence	% of all[1] occurrence	% of all[2] stations
Crepidula nummaria	2	0.263	2,062
Velutina sp.	1	0.132	1.031
Fusitrition oregonensis	10	1.316	10.309
Nucella lamellosa	3	0.395	3.093
Neptunea lyrata	8	1.053	8.247
Gonatidae	1	0.132	1.031
Gonatus sp.	2	0.263	2.062
octopus sp.	1	0.132	1.031
Balanus balanus	1	0.132	1.031
Balanus hesperius	3	0.395	3.093
Balanus rostratus	1	0.132	1.031
Amphipoda	1	0.132	1,031
Pandalus borealis	66	8.684	68.041
Pandalus goniurus	39	5.132	40.206
Pandalus hypsinotus	7 0	9.211	72.165
Pandalopsis dispar	19	2.500	19.588
Eualus biunguis	30	3.947	30.928
Eualus gaimardii belcheri	24	3.158	24.742
Eualus macilenta	14	1.842	14.433
Crangon dalli	17	2.237	17.526
Crangon communis	19	2,500	19.588
Sclerocrangon boreas	2	0.263	2.062
Argis sp.	3	0.395	3.093
Argis lar	14	1.842	14.433
Argis dentata	28	3.684	28.866
Argis crassa	3	0.395	3.093
Pagurus sp.	1	0.132	1.031
Pagurus ochotensis	18	2.368	18.557
Pagurus aleuticus	20	2.632	20.619
Pagurus capillatus	11	1.447	11.340

Appendix Table 1 (continued)

Taxonomic name	Cumulative occurrence	% of all[1] occurrence	% of all[2] stations
Pagurus kennerlyi	2	0.263	2.062
Pagurus beringanus	1	0.132	1.031
Labidochirus splendescens	5	0.658	5.155
Paralithodes camtschatica	66	8.684	68.041
Paralithodes platypus	1	0.132	1.031
Oregonia gracilis	16	2.105	16.495
Hyas lyratus	5	0.658	5.155
Chionoecetes bairdi	95	12.500	97.938
Pugettia gracilis	6	0.789	6.186
Cancer magister	6	0.789	6.186
Cancer oregonensis	5	0.658	5.155
Telmessus cheiragonus	1	0.132	1.031
Sipunculida	1	0,132	1.031
Ectoprocta	1	0.132	10031
Terebratalia transversa	1	0.132	1.031
Henricia sp.	4	0.526	4.124
Pteraster tesselatus	1	0.132	1.031
Evasterias echinosoma	2	0.263	2.062
Evasterias troschelii	3	0.395	3.093
Stylasterias forreri	1	0.132	1.031
Pycnopodia helianthoides	1	0,132	1.031
Strongylocentrotus droebachiensis	6	0.789	6.186
Molpadia sp.	1	0.132	1.031
Cucumaria sp.	1	0.132	1.031
Chordata:Ascidiacea	7	0.921	7.216
TOTAL	760	100.000	

[1] $\frac{\text{cumulative occurrence}}{\text{total cumulative occurrence}}$

[2] $\frac{\text{cumulative occurrence}}{\text{total no. of stations occupied}}$

Appendix Table 2

PERCENTAGE COMPOSITION BY WEIGHT OF ALL PHYLA FROM ALL STATIONS IN ALITAK BAY - JUNE, JULY, AND AUGUST 1976, AND MARCH 1977

Taxonomic name	Total No. indiv. (count)	% Count	Weight (gin)	% Weight	gm/m^2 all Sta.
Porifera	649	0.2193	43866.00	0.3755	0.02248
Cnidaria	71	0.0238	12230.72	0.1047	0.00627
Annelida	131	0.0443	233.00	0.0020	0.00012
Mollusca	276	0.0934	16629.67	0.1423	0.00852
Arthropoda:Crustacea	294718	99.5748	11586552.50	99.1751	5.93870
Sipunculida	1	0.0003	8.00	0.0001	0.00000
Ectoprocta	1	0.0003	225.00	0.0019	0.00012
Brachiopoda	2	0.0007	28.00	0.0002	0.00001
Echinodermata	78	0.0262	22622.67	0.1936	0.01160
Chordata:Ascidiacea	50	0.0168	524.33	0.0045	0.00027
TOTALS	295977	100.0000	11682919.89	100.0000	5.98810

Appendix Table 3

PERCENTAGE COMPOSITION OF ALL PHYLA BY FAMILY FROM ALL STATIONS IN ALITAK BAY - JUNE, JULY, AND AUGUST 1976, AND MARCH 1977

Taxonomic name	Total No. indiv. (count)	% Count	Weight (gm)	% Weight	gm/m^2 all Sta.
Porifera (unid. family)	649	0.2193	43866.00	0.3755	0.02248
Hydrozoa (unid. family)	4	0.0012	1854.33	0.0159	0.00095
Scyphozoa (unid. family)	1	0.0003	100.00	0.0009	0.00005
Pennatulacea pennatulidae	30	0.0102	597.00	0.0051	0.00031
Actinostolidae	4	0.0014	1360.00	0.0116	0.00070
Actiniidae	32	0.0107	8319.38	0.0712	0.00426
Polychaeta (unid. family)	8	0.0027	16.00	0.0001	0.00001
Polynoidae	2	0.0007	2.00	0.0000	0.00000
Nereidae	10	0.0034	22.00	0.0002	0.00001
Serpulidae	100	0.0338	170.00	0.0015	0.00009
Hirudinea (unid. family)	2	0.0006	1.67	0.0000	0.00000
Acanthochitonidae	9	0.0032	21.33	0.0002	0.00001
Nuculanidae	7	0.0023	55.67	0.0005	0.00003
Mytilidae	32	0.0108	748.00	0.0064	0.00038
Pectinidae	10	0.0034	1832.33	0.0157	0.00094
Anomiidae	4	0.0014	80.00	0.0007	0.00004
Astartidae	4	0.0014	8.00	0.0001	0.00000
Cardiidae	3	0.0010	650.00	0.0056	0.00033
Veneridae “	3	0.0010	128.00	0.0011	0.00007

Appendix Table 3 (continued)

Taxonomic name	Total No. indiv. (count)	% Count	Weight (gin)	% Weight	gm/m^2 all Sta.
Tellinidae	12	0.0041	198.00	0.0017	0.00030
Hiatellidae	71	0.0240	46.00	0.0004	0.00002
Calypt raeidae	4	0.0014	3.00	0.0000	0.00000
Velutinidae	1	0.0003	2.00	0.0000	0.00000
Cymatiidae	103	0.0349	11380.33	0.0974	0.00583
Thaididae	4	0.0014	25.00	0.0002	0.00001
Neptuneidae	14	0.0047	1010.00	0.0086	0.00052
Gonatidae	3	0.0010	130.00	0.0011	0.00007
Octopodidae	1	0.0005	333.33	0.0029	0.00017
Balanidae	257	0.0868	3525.00	0.0302	0.00181
Amphipoda (unid. family)	2	0.0007	1.00	0.0000	0.00000
Pandalidae	263376	88.9854	2316668.75	19.8295	1.18741
Hippolytidae	14560	4.9191	109340.33	0.9359	0.05604
Crangonidae	5277	1.7830	40458.00	0.3463	0.02074
Paguridae	328	0.1107	6643.21	0.0569	0.00340
Lithodidae	3013	1.0180	4366325.50	37.3736	2.23797
Maj idae	7874	2.6604	4731857.00	40.5024	2.42532
Cancridae.	31	0.0104	11563.67	0.0990	0.00593
Atelecyclidae	1	0.0003	170.00	0.0015	0.00009
Sipunculida (unid. family)	1	0.0003	8.00	0.0001	0.00000

Appendix Table 3 (continued)

Taxonomic name	Total No. indiv. (count)	% Count	Weight (gin)	% Weight	gm/m^2 all Sta.
Ectoprocta (unid. family)	1	0.0003	225.00	0.0019	0.00012
Dallinidae	2	0.0007	28.00	0.0002	0.00001
Echinasteridae	7	0.0024	198.00	0.0017	0.00010
Pterasteridae	1	0.0003	45.00	0.0004	0.00002
Asteridae	52	0.0176	21411.00	0.1833	0.01097
Strongylocentrotidae	15	0.0053	40.67	0.0003	0.00002
Molpadiidae	1	0.0003	20.00	0.0002	0.00001
Cucumariidae	1	0.0003	908.00	0.0078	0.00047
Chordata:Ascidiacea (unid. family)	50	0.0168	524.33	0.0045	0.00027

Appendix Table 4

PERCENTAGE COMPOSITION OF ALL PHYLA BY SPECIES FROM ALL STATIONS IN ALITAK BAY - JUNE, JULY, AND AUGUST 1976, AND MARCH 1977

Taxonomic names represent the lowest level of identification.

Taxonomic name	Total No. indiv. (count)	% Count	Weight (gin)	% Weight	gm/m^2 Occurrence station	gm/m^2 All Sta.	% of Phylum (count)	% of Phylum (weight)
Porifera	649	0.2	43866.00	0.38	0.1080	0.02248	100.00	100.00
Hydrozoa	4	0.0	1854.33	0.02	0.0329	0.00095	5.20	15.16
Scyphozoa	1	0.0	100.00	0.00	0.0044	0.00005	1.42	0.82
Ptilosarcus gurneyi	30	0.0	597.00	0.01	0.0038	0.00031	43.00	4.88
Stomphia coccinea	4	0.0	1360.00	O*O1	0.0603	0.00070	5.67	11.12
Actiniidae	30	0.0	8119.38	0.07	0.0554	0.00416	41.88	66.39
Tealia crassicornis	2	0.0	200.00	0.00	0.0178	0.00010	2.84	1.64
Polychaeta	8	0.0	16.00	0.00	0.0014	0.00001	6.11	6.87
Polynoidae	2	0.0	2.00	0.00	0.0002	0.00000	1.53	0.86
Nereis sp.	10	0.0	22.00	0.00	0.0010	0.00001	7.63	9.44
Crucigera irregularis	100	0.0	170.00	0.00	0.0151	0.00009	76.34	72.96
Hirudinea	2	0.0	1.67	0.00	0.0001	0.00000	1.27	0.72
Notostomobdella sp.	9	0.0	21.33	0.00	0.0001	0.00001	7.12	9.16
Nuculana fossa	6	0.0	5.67	0.00	0.0001	0.00000	2.05	0.03
Yoldia thraciaeformis	1	0.0	50.00	0.00	0.0022	0.00003	0.36	0.30
Myti lus edulis	2	0.0	80.00	0.00	0.0071	0.00004	0.72	0.48
Musculus discors	30	0.0	668.00	0.01	0.0148	0.00034	10.86	4.02
Chlamys rubida	8	0.0	1307 .33	0.01	0.0232	0.00067	2.77	7.86
Pecten caurinus	3	0.0	525.00	0.00	0.0233	0.00027	0.90	3.16

Appendix Table 4 (continued)

Taxonomic name	Total No. indiv. (count)	% Count	Weight (gm)	% Weight	gm/m^2 Occurrence station	gm/m^2 All Sta.	% of Phylum (count)	% of Phylum (weight)
Pododesmus macrochisma	4	0.0	80.00	0.00	0.0071	0.00004	1.45	0.48
Astarte rollandi	2	0.0	4.00	0.00	0.0004	0.00000	0.72	0.02
Astarte esquimalti	2	0.0	4.00	0.00	0.0004	0.00000	0.72	0.02
Clinocardium ciliatum	1	0.0	30.00	0.00	0.0013	0.00002	0.36	0.18
Serripes groenlandicus	2	0.0	620.00	0.01	0.0137	0.00032	0.72	3.73
Saxidomus gigantea	2	0.0	118.00	0.00	0.0105	0.00006	0.72	0.71
Protothaca staminea	1	0.0	10.00	0.00	0.0004	0.00001	0.36	0.06
Macoma calcarea	12	0.0	198.00	0.00	0.0018	0.00010	4.34	1.19
Hiatella arctica	71	0.0	46.00	0.00	0.0004	0.00002	25.69	0.28
Crepidula nummaria	4	0.0	3.00	0.00	0.0001	0.00000	1.45	0.02
Velutina sp.	1	0.0	2.00	0.00	0.0002	0.00000	0.36	0.01
Fusitrition oregonensis	103	0.0	11380.33	0.10	0.0561	0.00583	37.33	68.43
Nucella lamellosa	4	0.0	25.00	0.00	0.0007	0.00001.	1.45	0.15
Neptunea lyrata	14	0.0	1010.00	0.01	0.0060	0.00052	5.07	6.07
Gonatidae	1	0.0	60.00	0.00	0.0027	0.00003	0.36	0.36
Gonatus sp.	2	0.0	70.00	0.00	0.0016	0.00004	0.72	0.42
octopus sp.	1	0.0	333.33	0.00	0.0148	0.00017	0.48	2.00
Balanus balanus	180	0.1	1814.00	0.02	0.1616	0.00093	0.06	0.02
Balanus hesperius	24	0.0	111.00	0.00	0.0025	0.00006	0.01	0.00
Balanus rostratus	53	0.0	1600.00	0.01	0.1426	0.00082	0.02	0.01

Appendix Table 4 (continued)

Taxonomic name	Total No. indiv. (count)	% Count	Weight (gm)	% Weight	gm/m^2 Occurrence station	gm/m^2 All Sta.	% of Phylum (count)	% of Phylum (weight)
Amphipoda	2	0.0	1.00	0.00	0.0001	0.00000	0.00	0.00
Pandalus borealis	81668	61.4	1581865.13	13.54	1.1129	0.81079	61.64	13.65
Pandalus goniurus	33109	11.2	270151.00	2.31	0.3193	0.13847	11.23	2.33
Pandalus hypsinotus	45510	15.4	414110.61	3.54	0.2846	0.21225	15.44	3.57
Pandalopsis dispar	3090	1.0	50542.00	0.43	0.1244	0.02591	1.05	0.44
Eualus biunguis	2409	0.8	20219.67	0.17	0.0326	0.01036	0.82	0.17
Eualus gaimardii belcheri	11289	3.8	81966.67	0.70	0.1513	0.04201	3.83	0.71
Eualus macilenta	862	0.3	7154.00	0.06	0.0226	0.00367	0.29	0.06
Crangon dalli	660	0.2	5816.33	0.05	0.0184	0.00298	0.22	0.05
Crangon communis	696	0.2	4893.67	0.04	0.0117	0.00251	0.24	0.04
Sclerocrangon boreas	87	0.0	289.00	0.00	0.0129	0.00015	0.03	0.00
Argis sp.	217	0.1	2825.00	0.02	0.0501	0.00145	0.07	0.02
Argis lar	1261	0.4	8770.00	0.08	0.0278	0.00450	0.43	0.08
Argis dentata	2350	0.8	17841.00	0.15	0.0293	0.00914	0.80	0.15
Argis crassa	7	0.0	23.00	0.00	0.0007	0,00001	0.00	0.00
Pagurus sp.	2	0.0	2.00	0.00	0.0002	0.00000	0.00	0.00
Pagurus ochotensis	192	0.1	3443.21	0.03	0.0109	0.00176	0.07	0.03
Pagurus aleuticus	82	0.0	2583.33	0.02	0.0064	0.00132	0.03	0.02
Pagurus capillatus	23	0.0	356.67	0.00	0.0017	0.00018	0.01	0.00

Appendix Table 4 (continued)

Taxonomic name	Total No. indiv. (count)	% count	Weight (gin)	% Weight	gin/m' Occurrence station	gm/m^2 All Sta.	% of Phylum (count)	% of Phylum (weight)
Pagurus kennerlyi	20	0.0	190.00	0.00	0.0085	0.00010	0.01	0.00
Pagurus beringanus	3	0.0	15.00	0.00	0.0013	0.00001	0.00	0.00
Labidochirus splendescens	5	0.0	53.00	0.00	0.0006	0.00003	0.00	0.00
Paralithodes camtschatica	3012	1.0	4365871.50	37.37	3.4268	2.23773	1.02	37.68
Paralithodes platypus	1	0.0	454.00	0.00	0.0201	0.00023	0.00	0.00
Oregonia gracilis	57	0.0	743.00	0.01	0.0023	0.00038	0.02	0.01
Hyas lyratus	35	0.O	2478.00'	0.02	0.0314	0.00127	0.01	0.02
Chionoecetes bairdi	7773	2.6	4728562.00	40.47	2.4518	2.42363	2.64	40.81
Pugettia gracilis	9	0.0	74.00	0-.00	0.0007	0.00004	0.00	0.00
Cancer magister	16	0.0	11519.67	0.10	0.0851	0.00590	0.01	0.10
Cancer oregonensis	15	0.0	44.00	0.00	0.0006	0.00002	0.01	0.00
Telmessus cheiragonus	1	0.0	170.00	0.00	0.0151	0.00009	0.00	0.00
Sipunculida	1	0.0	8.00	0.00	0.0004	0.00000	100.00	100.00
Ectoprocta	1	0.0	225.00	0.00	0.0200	0.00012	100.00	100.00
Terebratalia transversa	2	0.0	28.00	0.00	0.0025	0.00001	100.00	100.00
Henricia sp.	7	0.0	198.00	0.00	0.0025	0.00010	9.01	0.88
Pteraster tesselatus	1	0.0	45.00	0.00	0.0020	0.00002	1.29	0.20
Evasterias echinosoma	7	0.O	5598.00	0.05	0.1657	0.00287	9.01	24.75
Evasterias troschelii	42	0.0	14473.00	0.12	0.3215	0.00742	54.08	63.98

Appendix Table 4 (continued)

Taxonomic name	Total No. indiv. (count)	% Count	Weight (gm)	% Weight	gm/m^2 Occurrence station	gm/m^2 All Sta.	% of Phylum (count)	% of Phylum (weight)
Stylasterias forreri	2	0.0	1250.00	0.01	0.1114	0.00064	2.58	5.53
Pycnopodia helianthoides	1	0.0	90.00	0.00	0.0040	0.00005	1.29	0.40
Strongylocentrotus droebachiensis	16	0.0	40.67	0.00	0.0004	0.00002	20.17	0.18
Molpadia sp.	1	0.0	20.00	0.00	0.0009	0.00001	1.29	0.09
Cucumaria sp.	1	0.0	908.00	0.01	0.0402	0.00047	1.29	*.01
Chordata:Ascidiacea	50	0.0	524.33	0.00	0.0039	0.00027	100.00	100.00

Appendix Table 5

OCCURRENCE OF EACH SPECIES IN UGAK BAY - JUNE, JULY, AND AUGUST 1976, AND MARCH 1977

A total of 98 stations were occupied. Taxonomic names represent lowest level of identification.

Taxonomic name	Cumulative occurrence	% of all[1] occurrence	% of all[2] stations
Porifera	32	3.493	32.653
Hydrozoa	4	0.437	4.082
Campanularia sp.	1	0.109	1.020
Lafoeidae	1	0.109	1.020
Sertulariidae	1	0.109	1,020
Sertularella sp.	1	0.109	1.020
Sertularia sp.	1	0.109	1.020
Abietinaria sp.	1	0.109	1.020
Plumulariidae	1	0,109	1.020
Scyphozoa	1	0.109	1.020
Stomphia coccinea	1	0.109	1.020
Actiniidae	20	2.183	20.408
Tealia crassicornis	2	0.218	2,041
Ctenophora	1	0.109	1.020
Polychaeta	6	0.655	6.122
Polynoidae	3	0.328	3.061
Spinther alaskensis	1	0.109	1.020
Nereis sp.	1	0.109	1.020
Crucigera irregularis	‘2	0.218	2.041
Nuculana fossa	13	1.419	13.265
Yoldia hyperborea	4	0.437	4.082
Mytilus edulis	3	0.328	3.061
Musculus discors	1	0.109	1.020
Modiolus modiolus	1	0.109	1.020
Chlamys rubida	2	0.218	2.041
Pecten caurinus	3	0.328	3.061
Clinocardium ciliatum	10	1.092	10.204
Clinocardium nuttallii	3	0.328	3.061

Appendix Table 5 (continued)

Taxonomic name	Cumulative occurrence	% of all[1] occurrence	% of all[2] stations
Serripes groenlandicus	6	0.655	6.122
Macoma calcarea	4	0.437	4.082
Macoma moesta	3	0.328	3.061
Hiatella arctica	4	0.437	4.082
Bankia sp.	1	0.109	1.020
Bankia setacea	3	0.328	3.061
Crepidula nummaria	1	0.109	1,020
Velutina sp.	1	0.109	1.020
Fusitrition oregonensis	4	0.437	4.082
Nucella lamellosa	1	0.109	1.020
Dorididae	1	0.109	1.020
Gonatus sp.	1	0.109	1.020
octopus sp.	1	0.109	1.020
Balanus sp.	1	0.109	1.020
Balanus balanus	10	1.092	10.204
Isopoda	1	0.109	1.020
Pandalus borealis	73	7.969	74.490
Pandalus goniurus	25	2.729	25.510
Pandalus hypsinotus	72	7.860	73.469
Pandalopsis dispar	10	1.092	10.204
Eualus biunguis	38	4.148	38.776
Eualus macilenta	3	0.328	3.061
Crangon dalli	33	3.603	33.673
Crangon communis	26	2.838	26.531
Argis sp.	6	0.655	6.122
Argis lar	9	0.983	9.184
Argis dentata	41	4.476	41.837
Pagurus ochotensis	23	2.511	23.469
Pagurus aleuticus	37	4.039	37.755
Pagurus capillatus	9	0.983	9.184

Appendix Table 5 (continued)

Taxonomic name	Cumulative occurrence	% of all[1] occurrence	% of all[2] stations
Pagurus kennerlyi	1	0.109	1.020
Pagurus beringanus	2	0.218	2.041
Elassochirus tenuimanus	3	0.328	3.061
Paralithodes camtschatica	93	10.153	94.898
Oregonia gracilis	17	1.856	17.347
Hyas lyratus	4	0.437	4.082
Chionoecetes bairdi	97	10.590	98.980
Pugettia gracilis	11	1.201	11.224
Cancer sp.	1	0.109	1.020
Cancer magister	5	0.546	5.102
Cancer oregonensis	10	1.092	10.204
Telmessus cheiragonus	3	0.328	3.061
Pinnixa occidentalis	1	0.109	1,020
Echiurus echiurus alaskanus	1	0.109	1.020
Ectoprocta	1	0,109	1.020
Flustridae	1	0.109	1.020
Microporina sp.	1	0.109	1.020
Flustrella	1	0.109	1.020
Brachiopoda	1	0.109	1.020
Terebratulina unguicula	1	0.109	1.020
Terebratalia transversa	1	0.109	1.020
Solaster stimpsoni	2	0.218	2,041
Evasterias echinosoma	2 1	2.293	21.429
Evasterias troschelii	9	0.983	9.184
Stylasterias forreri	1	0.109	1.020
Pycnopodia helianthoides	2	0.218	2.041
Strongylocentrotus droebachiensis	22	2.402	22.449
Ophiuroidea	1	0.109	1.020
Gorgonocephalus caryi	1	0.109	1.020
Ophiopholis aculeata	1	0.109	1.020

Appendix Table 5 (continued)

Taxonomic name	Cumulative occurrence	% of all[1] occurrence	% of all[2] stations
Cucumaria sp.	5	0.546	5.102
Chordata:Ascidiacea	24	2.620	24.490
Pelonaia corrugata	2	0.218	2.041
TOTAL	916	100.000	

[1] $\frac{\text{cumulative occurrence}}{\text{total cumulative occurrence}}$

[2] $\frac{\text{cumulative occurrence}}{\text{total no. of stations occupied}}$

Appendix Table 6

PERCENTAGE COMPOSITION BY WEIGHT OF ALL PHYLA FROM ALL STATIONS IN UGAK BAY - JUNE, JULY, AND AUGUST 1976, AND MARCH 1977

Taxonomic name	Total No. indiv. (count)	% Count	Weight (gm)	% Weight	gm/m^2 all Sta.
Porifera	1037	0.6207	89350.55	1.2559	0.04439
Cnidaria	275	0.1645	44755.90	0.6291	0.02223
Ctenophora	2	0.0012	40.00	0.0006	0.00002
Annelida	1692	1.0133	3980.02	0.0559	0.00198
Mollusca	570	0.3412	6482.70	0.0911	0.00322
Arthropoda:Crustacea	162337	97.1995	6819853.63	95.8575	3.38791
Echiuroidea	2	0.0010	25.00	0.0004	0.00001
Ectoprocta	291	0.1740	102.00	0.0014	0.00005
Brachiopoda	74	0.0446	362.14	0.0051	0.00018
Echinodermata	577	0.3456	137365.27	1.9308	0.06824
Chordata:Ascidiacea	158	0.0945	12255.86	0.1723	0.00609
TOTALS	167015	100.0000	7114573.07	100.0000	3.53430

Appendix Table 7

PERCENTAGE COMPOSITION OF ALL PHYLA BY FAMILY FROM ALL STATIONS IN UGAK BAY - JUNE, JULY, AND AUGUST 1976, AND MARCH 1977

Taxonomic name	Total No. indiv. (count)	% Count	Weight (gin)	% Weight	gm/m^2 all Sta.
Porifera (unid. family)	1037	0.6207	89350.55	1.2559	0.04439
Hydrozoa (unid. family)	6	0.0038	385.71	0.0054	0.00019
Campanulariidae	1	0.0009	28.57	0.0004	0.00001
Lafoeidae	1	0.0009	28.57	0.0004	0.00001
Sertulariidae	6	0.0034	342.86	0.0048	0.00017
Plumulariidae	1	0.0009	14.29	0.0002	0.00001
Scyphozoa (unid. family)	1	0.0006	45.00	0.0006	0.00002
Actinostolidae	8	0.0048	650.00	0.0091	0.00032
Actiniidae	249	0.1492	43260.90	0.6081	0.02149
Ctenophora (unid. family)	2	0.0012	40.00	0.0006	0.00002
Polychaeta (unid. family)	1556	0.9314	3877.57	0.0545	0.00193
Polynoidae	60	0.0362	61.81	0.0009	0.00003
Spintheridae	1	0.0009	1.43	0.0000	0.00000
Nereidae	3	0.0015	2.50	0.0000	0.00000
Serpulidae	72	0.0434	36.71	0.0005	0.00002
Nuculanidae	113	0.0678	102.74	0.0014	0.00005
Mytilidae	166	0.0993	948.14	0.0133	0.00047
Pectinidae	8	0.0051	2279.78	0.0320	0.00113
Cardiidae	51	0.0305	1690.00	0.0238	0.00084
Tellinidae	12	0.0072	702.62	0.0099	0.00035

Appendix Table 7 (continued)

Taxonomic name	Total No. indiv. (count)	% Count	Weight (gin)	% Weight	gm/m^2 all Sta.
Hiatellidae	54	0.0324	39.18	0.0006	0.00002
Teredinidae	150	0.0896	59.71	0.0008	0.00003
Calyptraeidae	1	0.0009	1.43	0.0000	0.00000
Velutinidae	1	0.0006	1.00	0.0000	0.00000
Cymatiidae	6	0.0037	353.33	0.0050	0.00018
Thaididae	2	0.0013	33.33	0.0005	0.00002
Dorididae	1	0.0009	1.43	0.0000	0.00000
Gonatidae	2	0.0012	20.00	0.0003	0.00001
Octopodidae	1	0.0006	250.00	0.0035	0.00012
Balanidae	65	0.0389	434.81	0.0061	0.00022
Isopoda (unid. family)	1	0.0006	1.00	0.0000	0.00000
Pandalidae	143596	85.9784	1392238.77	19.5688	0.69162
Hippolytidae	3793	2.2712	35734.55	0.5023	0.01775
Crangonidae	4589	2.7478	41478.04	0.5830	0.02061
Paguridae	266	0.1591	7927.65	0.1114	0.00394
Lithodidae	3460	2.0719	2586714.91	36.3580	1.28500
Majidae	6421	3.8445	2743048.47	38.5554	1.36267
Cancridae	137	0.0822	10856.42	0.1526	0.00539
Atelecyclidae	6	0.0035	1416.43	0.0199	0.00070
Pinnotheridae	3	0.0015	2.50	0.0000	0.00000
Echiuridae	2	0.0010	25.00	0.0004	0.00001

Appendix Table 7 (continued)

Taxonomic name	Total No. indiv. (count)	% Count	Weight (gin)	% Weight	gin/m* all Sta.
Ectoprocta (unid. family)	2	0.0012	2.00	0.0000	0.00000
Flus tridae	1	0.0009	7.14	0.0001	0.00000
Microporidae	1	0.0009	7.14	0.0001	0.00000
Flustrellidae	286	0.1711	85.71	0.0012	0.00004
Brachiopoda (unid. family)	71	0.0428	357.14	0.0050	0.00018
Cancellothyrid idae	1	0.0006	1.00	0.0000	0.00000
Dallinidae	2	0.0012	4.00	0.0001	0.00000
Solasteridae	4	0.0025	275.00	0.0039	0.00014
Asteridae	197	0.1180	130035.57	1.8277	0.06460
Strongylocentrotidae	336	0.2009	1346.13	0.0189	0.00067
Ophiuroidea (unid. family)	2	0.0012	2.00	0.0000	0.00000
Gorgonocephalidae	1	0.0008	80.00	0.0011	0.00004
Ophiactidae	29	0.0171	28.57	0.0004	0.00001
Cucumariidae	9	0.0051	5598.00	0.0787	0.00278
Chordata:Ascidiacea (unid. family)	128	0.0768	12190.71	0.1713	0.00606
Styelidae	30	0.0177	65.14	0.0009	0.00003

Appendix Table 8

PERCENTAGE COMPOSITION OF ALL PHYLA BY SPECIES FROM ALL STATIONS IN UGAK BAY - JUNE, JULY, AND AUGUST 1976, AND MARCH 1977

Taxonomic names represent the lowest level of identification.

Taxonomic name	Total No. indiv. (count)	% Count	Weight (gm)	% Weight	gm/m^2 Occurrence station	gm/m^2 All Sta.	% of Phylum (count)	% of Phylum (weight)
Porifera	1037	0.6	89350.55	1.26	0.1366	0.04439	100.00	100.00
Hydrozoa	6	0.0	385.71	0.01	0.0043	0.0019	2.34	0.86
Campanularia sp.	1	0.0	28.57	0.00	0.0013	0.0001	0.52	0.06
Lafoeidae	1	0.0	28.57	0.00	0.0013	0.0001	0.52	0.06
Sertulariidae	1	0.0	85.71	0.00	0.0038	0.0004	0.52	0.19
Sertularella sp.	1	0.0	85.71	0.00	0.0038	0.0004	0.52	0.19
Sertularia sp.	1	0.0	85.71	0.00	0.0038	0.0004	0.52	0.19
Abietinaria sp.	1	0.0	85.71	0.00	0.0038	0.0004	0.52	0.19
Plumulariidae	1	0.0	14.29	0.00	0.0006	0.0001	0.52	0.03
Scyphozoa	1	0.0	45.00	0.00	0.0020	0.0002	0.36	0.10
Stomphia coccinea	8	0.0	650.00	0.01	0.0579	0.0032	2.91	1.45
Actiniidae	246	0.1	43100.90	0.01	0.1108	0.2141	89.65	96.30
Tealia crassicornis	3	0.0	160.00	0.00	0.0035	0.0008	1.09	0.36
Ctenophora	2	0.0	40.00	0.00	0.0018	0.0002	100.00	100.00
Polychaeta	1556	0.9	3[illegible]77.57	0.05	0.0344	0.0193	91.91	97.43
Polynoidae	61	0.0	61.81	0.00	0.0011	0.0003	3.57	1.55
Spinther alaskensis	1	0.0	1.43	0.00	0.0001	0.0000	0.08	0.04
Nereis sp.	3	0.0	2.50	0.00	0.0001	0.00000	0.15	0.06
Crucigera irregularis	72	0.0	36.71	0.00	0.0011	0.0002	4.28	0.92

Appendix Table 8 (continued)

Taxonomic name	Total No. indiv. (count)	% count	Weight (gin)	% Weight	gm/m^2 Occurrence station	gm/m^2 All Sta.	% of Phylum (count)	% of Phylum (weight)
Nuculana fossa	103	0.1	74.07	0.00	0.0003	0.00004	18·.00	1.14
Yoldia hyperborea	11	0.0	28.67	0.00	0.0004	0.00001	1.87	0.44
Mytilus edulis	48	0.0	480.00	0.01	0.0071	0.00024	8.35	7.40
Musculus discors	114	0.1	457.14	0.01	0.0203	0.00023	20.06	7.05
Modiolus modiolus	4	0.0	11.00	0.00	0.0005	0.00001	0.70	0.17
Chlamys rubida	3	0.0	21.11	0.00	0.0007	0.00001	0.55	0.33
Pecten caurinus	5	0.0	2258.67	0.03	0.0502	0.00112	0.94	34.s4
Clinocardium ciliatum	33	0.0	321.67	0.00	0.0017	0.00016	5.85	4.96
Clinocardium nuttallii	5	0.0	996.67	0.O1	0.0177	0.00050	0.82	15.37
Serripes groenlandicus	13	0.0	371..67	0.01	0.0033	0.00018	2.28	5.73
Macoma calcarea	6	0.0	520.95	0.01	0.0058	0.00026	1.07	8.04
Macoma moesta	6	0.0	181.67	0.00	0.0032	0.00009	1.05	2.80
Hiatella arctica	54	0.0	39.18	0.00	0.0004	0.00002	9.51	0.60
Bankia sp.	36	0.0	35.71	0.00	0.0032	0.00002	6.27	0.55
Bankia setacea	114	0.1	24.00	0.00	0.0004	0.00001	20.01	0.37
Crepidula nummaria	1	0.0	1.43	0.00	0.0001	0.00000	0.25	0.02
Velutina sp.	1	0.0	1.00	0.00	0.0001	0.00000	0.18	0.02
Fusitrition oregonensis	6	0.0	353.33	0.00	0.0052	0.00018	1.08	5.45
Nucella lamellosa	2	0.0	33.33	0.00	0.0015	0.00002	0.39	0.51
Dorididae	1	0.0	1.43	0.00	0.0001	0.00000	0.25	0.02

Appendix Table 8 (continued)

Taxonomic name	Total No. indiv. (count)	% Count	Weight (gm)	% Weight	gm/m^2 Occurrence station	gm/m^2 All Sta.	% of Phylum (count)	% of Phylum (weight)
Gonatus sp.	2	0.0	20.00	0.00	0.0009	0.00001	0.35	0.31
Octopus sp.	1	0.0	250.00	0.00	0.0111	0.00012	0.18	3.86
Balanus sp.	3	0.0	15.00	0.00	0.0013	0.00001	0.00	0.00
Balanus balanus	62	0.0	419.81	0.01	0.0021	0.00021	0.0[illegible]	0.01
Isopoda	1	0.0	1.00	0.00	0.0000	0.00000	0.00	0.00
Pandalus borealis	91226	5[illegible].6	8819[illegible]3.[illegible]2	12.40	0.5770	0.43813	56.20	12.93
Pandalus goniurus	26688	16.0	253044.02	3.56	0.4773	0.12570	16.44	3.71
Pandalus hypsinotus	25344	15.2	253817.72	3.57	0.1643	0.12609	15.61	3.72
Pandalopsis dispar	338	0.2	3414.00	0.05	0.0159	0.00170	0.21	0.05
Eualus biunguis	3737	2.2	35336.55	0.50	0.0432	0.01755	2.30	0.52
Eualus macilenta	56	0.0	398.00	0.01	0.0059	0.00020	0.03	0.01
Crangon dalli	1328	0.8	10970.75	0.15	0.0158	0.00545	0.82	0.16
Crangon communis	788	0.5	5342.95	0.08	0.0099	0.00265	0.49	0.08
Argis sp.	495	0.3	11192.00	0.16	0.0826	0.00556	0.30	0.16
Argis lar	377	0.2	2640.00	0.04	0.0130	0.00131	0.23	0.0[illegible]
Argis dentata	1601	1.0	11332.34	0.16	0.0132	0.00563	0.99	0.17
Pagurus ochotensis	115	0.1	4253.33	0.06	0.0099	0.00211	0.07	0.06
Pagurus aleuticus	116	0.1	3302.73	0.05	0.0044	0.00164	0.07	0.05
Pagurus capillatus	27	0.0	288.02	0.00	0.0016	0.00014	0.02	0.00
Pagurus kennerlyi	1	0.0	28.57	0.00	0.0013	0.00001	0.00	0.00

Appendix Table 8 (continued)

Taxonomic name	Total No. indiv. (count)	% count	Weight (gin)	% Weight	gm/m² Occurrence station	gm/m² All Sta.	% of Phylum (count)	z of Phylum (weight)
Pagurus beringanus	3	0.0	35.00	0.00	0.0008	0.00002	0.00	0.00
Elassochirus tenuimanus	4	0.0	20.00	0.00	0.0004	0.00001	0.00	0.00
Paralithodes canrts-chatica	3460	2.1	2586714.91	36.36	1.3613	1.28500	2.13	37.93
Oregonia gracilis	121	0.1.	1583.57	2.02	0.0045	0.00079	0.07	0.02
Hyas lyratus	13	0.0	424.29	0.01	0.0054	0.00021	0.01	0.01
Chionoecetes bairdi	6086	3.6	2740746.19	38.52	1.3770	1.36152	3.75	40.19
Pugettia gracilis	201	0.1	294.43	0.00	0.0013	0.00015	0.12	0.00
Cancer sp.	3	0.0	2.50	0.00	0.0001	0.00000	0.00	0.00
Cancer magister	10	0.0	10309.35	0.14	0.1016	0.00512	0.01	0.15
Cancer *oregonensis*	125	0.1	544.57	0.01	0.0030	0.00027	0.08	0.01
Te lmessus cheiragonus	6	0.0	1416.43	0.02	0.0209	0.00070	0.00	0.02
Pinnixa occidental	3	0.0	2.50	0.00	0.0001	0.00000	0.00	0.00
Echiurus echiurus alaskensis	2	0.0	25.00	0.00	0.0011	0.00001	100.00	100.00
Ectoprocta	2	0.0	2.00	0.00	0.0001	0.00000	0.69	1.96
Flus tridae	1	0.0	7.14	0.00	0.0003	0.00000	0.49	7000
Microporina sp.	1	0.0	7.14	0.00	0.0003	0.00000	0.49	7.00
Flustrella	286	0.2	85.71	0.00	0.0038	0.00004	98.33	84.03
Brachiopoda	71	0.0	357.14	0.01	0.0158	0.00018	95.97	98.62
Terebratulina unguicula	1	0.0	1.00	0.00	0.0001	0.00000	1.34	0.28

Appendix Table 8 (continued)

Taxonomic name	Total No. indiv. (count)	% Count	Weight (gin)	% Weight	gm/m^2 Occurrence station	gm/m^2 All Sta.	% of Phylum (count)	% of Phylum (weight)
Terebratalia transversa	2	0.0	4.00	0.00	0.0004	0.00000	2.69	1.10
Solaster stimpsoni	4	0.0	275.00	0.00	0.0061	0.00014	0.72	0.20
Evasterias echinosoma	99	0.1	13268.89	0.19	0.0310	0.00659	17.12	9.66
Evasterias troschelii	22	0.0	4255.57	0.06	0.0236	0.00211	3.76	3.10
Stylasterias forreri	1	0.0	20.00	0.00	0.0009	0.00001	0.17	0.01
Pycnopodia helianthoides	76	0.0	112491.11	1.58	3.3287	0.05588	13.09	81.89
Strongylocentrotus droebachiensis	336	0.2	1346.13	0.02	0.0028	0.00067	58.13	0.98
Ophiuroidea	2	0.0	2.00	0.00	0.0001	0.00000	0.35	0.00
Gorgonocephalus caryi	1	0.0	80.00	0.00	0.0071	0.00004	0.23	0.06
Ophiopholis aculeata	29	0.0	28.57	0.00	0.0013	0.00001	4.95	0.02
Cucumaria sp.	9	0.0	5598.00	0.08	0.0496	0.00278	1.47	4.08
Chordata:Ascidiacea	128	0$'1	12190.71	0.17	0.0246	0.00606	81.27	99.47
Pelonaia corrugata	30	0.0	65.14	0.00	0.0014	0.00003	18.73	0.53